MAT152: Statistical Methods I: Activity 5

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.

Global Learning Outcomes:

1) Investigate and understand global issues through statistical analysis.

2) Use statistical techniques to draw inferences about global populations.

3) Interpret cross-cultural data and communicate results *(in written and verbal formats).*

Case Fatality Rates for Ebola and Hypothesis Testing   **by Debbie Anderson**
Students will gain a deeper understanding of Ebola and the recent outbreak in West Africa. They will use a statistical analysis to test hypotheses about the difference in the Incidence Rate of men and women in each of the 3 affected countries.
Objective:
This lab is a follow-up activity to Activity 4 (Case Fatality Rates for Ebola and Confidence Intervals). In this activity, students will learn about some cultural practices of West Africa and how they contributed to the spread of Ebola in the affected countries. After gaining an understanding of the effect cultural practices played in the outbreak, students will hypothesize about whether or not they think the effect was similar for men and women. In particular, was the Incidence Rate different for men and women? World Health Organization data will be used to test hypotheses. Finally, the group will discuss their findings and write a written summary.
Time:
1-2 hours
Materials:
1. https://en.wikipedia.org/wiki/Cultural_effects_of_the_Ebola_crisis   2. http://news.nationalgeographic.com/2015/01/150130-ebola-virus-outbreak-epidemic-sierra-leone-funerals/   3. http://www.un.org/ebolaresponse/pdf/Annex2.pdf   4. http://worldpopulationreview.com/countries/guinea-population/   5. http://worldpopulationreview.com/countries/liberia-population/

6. http://worldpopulationreview.com/countries/sierra-leone-population/

7. http://apps.who.int/gho/data/node.ebola-sitrep.quick-downloads?lang=en

8. http://www.un.org/apps/news/story.asp?NewsID=52790#.V0TAyPkrLIU

9. Computer and internet access

10. Pencil and notebook paper.

11. Copy of the attached activity.

Procedure:

This activity should be done after teaching Hypothesis Testing.

This activity has three pieces which are as follows:

(1) Preparation piece: This piece is to be completed before class. Students will research cultural practices of West Africa and how they relate to the Ebola outbreak. They will complete a set of short answer questions. Answers will be written on notebook paper. Each student must have these completed before class.

(2) In class. Students will work in groups of 2. (NOTE: Students who have not completed the prep work will go to a separate area of the room and do the prep work before proceeding. They will become group(s). Warning: It will be hard to complete the lab in class if the prep work has not been completed prior to class.)

Each group will choose one student who will write down the work for the remainder of the lab on his/her notebook paper.

(a) Students will formulate a hypothesis about the difference in Incidence Rates of Ebola for men and women. In one or two sentences, they will explain how/why they decided on this hypothesis. They will then set up a formal H_O and H_A using correct symbols.

(b) Students will link to websites to get population and case data necessary to test their hypothesis. These data will be copied into Table 1.

(c) Students will test their hypothesis separately for each country.

(d) A summary of results will be written.

(3) Follow-Up. The following link contains a 4-minute video from Dr. David Nabarro, the U.N. Special Envoy on Ebola, from Dec. 2015. In this video, Dr. Nabarro reflects on the lessons learned from the outbreak and the global response, and how he was able to *see humanity at its best during the experience*. This video should be shown to the class the day the lab papers

are returned to the students.

http://www.un.org/apps/news/story.asp?NewsID=52790#.V0TAyPkrLIU

Assessment:
Each student's paper will be graded separately for the Preparation Piece questions. A group grade for the remainder of the lab will be given. The activity will be worth a total of 100 points.

The Ebola Epidemic in West Africa

From Dec. 2013 through late 2015 Ebola ravaged the 3 West African countries Guinea, Liberia, and Sierra Leone. Unprepared and lacking the resources needed, the 3 countries fell victim to the worst outbreak of Ebola the world had ever seen. Thousands of people died. Many important lessons were learned, among them the need for good local leadership and community engagement to educate people about the disease (its cause, transmission, and prevention) and to ensure infected people got the help they needed immediately. With help from the international community, the outbreak was declared officially over in January 2016.

An important issue that arose with the outbreak of Ebola, not entirely recognized initially, was how the culture of West Africa would affect the severity of the outbreak. A related question was, would men and women be affected similarly? These questions will be investigated in this activity.

Preparation Work: You will begin this activity by researching the cultural practices of West Africa and the impact they had on the spread of Ebola. Reference websites have been provided.

In class: Using population and World Health Organization data, test hypotheses about the differences in Incidence Rate for men and women.

Follow-up: Watch a 4-minute video, narrated by the U.N. Special Envoy on Ebola, that reflects on the lessons learned from the outbreak.

Cultural Practices of West Africa. The following is an overview of the cultural practices of West Africa and how they relate to Ebola.

https://en.wikipedia.org/wiki/Cultural_effects_of_the_Ebola_crisis
1. What methods did West Africans traditionally use to cure ailments and how did this affect their acceptance of Western medical practices?
2. What cultural practice, involving sick members of a family, is contrary to the safe care of an Ebola patient, and why is it contrary?
3. Traditional folklore and music are used to explain existential interrelationships as well as current events. What was the nature of the song "White Ebola?"
4. What are some unfortunate things that happened as a result of "misinformation" that hampered the control of Ebola, especially in Guinea?
5. What West African funeral practice encouraged the spread of Ebola, and who, traditionally, would perform this ritual?
6. According to the Wesley Medical Center, prohibiting African families from performing traditional burial rites is a disgrace and an insult and was felt to put the family in danger. What happened in Liberia as a result?
7. In reference to the above, what practice was implemented in Sierra Leone that reconciled this situation?
8. What was it about the health care workers themselves that frightened many West Africans?
9. What primary source of protein in West Africa is a source of Ebola and how is the Ebola transmitted?

Funeral Practices and Sierra Leone. The following is an exceptionally good, but graphic, article about the funeral practices in West Africa and the "journey" the people of Sierra Leone had to take in order to stop the spread of, and then eradicate Ebola.

http://news.nationalgeographic.com/2015/01/150130-ebola-virus-outbreak-epidemic-sierra-leone-funerals/

11. What West African cultural burial practice, performed on a pregnant woman who had died, was "unallowed' by health officials in the interest of controlling Ebola, and how was the situation successfully handled?
12. What practice made people think Ebola was a hoax and what effect did this have?
13. In Sierra Leone, it has been claimed that burial practices accounted for how much of all new Ebola infections?

Eventually, health officials reached out to religious leaders and compromises were made. Ebola began its decline.

14. Communities became educated to the point that corpses were no longer hidden. In fact, health officials were now getting calls requesting what?

In-Class work.

In this activity, you will be looking at the number of Ebola cases in each country, by gender. Read the following to become familiar with the 3 definitions of "case" as applied to Ebola.

http://www.un.org/ebolaresponse/pdf/Annex2.pdf

Incidence Rate - Postulating a hypothesis

Based on what you have learned about cultural practices in West Africa, do you think the Incidence Rate (defined to be the number of Confirmed Cases divided by the population size) for men is greater than, equal to, or less than the Incidence Rate for women?
Explain in one or two sentences your opinion (claim) and then set up an H_0 and H_A, using correct symbols and identifying the claim (NOTE: Your claim could be in either H_0 or H_A.)
Do not peek at the data! There is no right or wrong answer. This is your opinion.

Testing your hypothesis

Population data is given in the following links. Use these data to fill in the second row of Table 1 for each country. Use the 2015 data. Fill in with numbers, not percentages (percentages are given in the link). After filling in the data for each country, combine data to get an overall figure.

Guinea population data (2015):
http://worldpopulationreview.com/countries/guinea-population/

Liberia population data (2015):
http://worldpopulationreview.com/countries/liberia-population/

Sierra Leone population data (2015):
http://worldpopulationreview.com/countries/sierra-leone-population/

Case data: NOTE: The number of "Confirmed" cases has been filled in Table 1 for you. These numbers were obtained from the most recent World Health Organization (WHO) data involving gender statistics. The link below will show you the Excel spreadsheet from which the numbers in Table 1 were obtained.

http://apps.who.int/gho/data/node.ebola-sitrep.quick-downloads?lang=en

After filling in the # cases and population, compute the Incidence Rate (5 decimal places).

Use the data in Table 1 to test your hypothesis at the .05 level of significance. Use the P-value approach and show all 5 steps. In particular: Set up hypotheses (identifying claim); compute the test-statistic; find the P-value; run test/make decision; interpret your decision in the context of the claim. Do a separate test for each country. As part of your answer, be sure to check that the conditions necessary to do the test have been met.

Summary

When you are finished, discuss the question below, as a group. Write a summary of your conclusions. Support your answer with evidence. Write your answer as if you were presenting the results to a scientific organization.

 Based on your results above, do you think the Incidence Rate of Ebola in West Africa is different for men and women? If you answered "yes," why do you think they differ? If you answered "no," why do you think they're the same.

Table 1
Ebola Incidence Rates
Dec. 2013 – May 2016

	Male	Female
# of cases	1599	1747
Population		
Incidence rate		

Guinea

# of cases	1911	1838
Population		
Incidence rate		

Liberia

# of cases	4823	5118
Population		
Incidence rate		

Sierra Leone