

Stat 104 – Homework 4 Solution

Assignment:

1. Complete the following problems from the text: 4.3, 4.7, 4.8, 4.15, 4.20, 4.21, 4.37, and 4.39.

If you have questions about the solutions to these problems, see your instructor.

2. The following is excerpted from an article written by Paul Recer, Associated Press, that appeared in the February 6, 2002 Des Moines Register.

Study: Tanning raises cancer risk.

In a study in today's *Journal of the National Cancer Institute*, researchers found that people who used tanning devices were 1.5 to 2.5 times more likely to have common kinds of skin cancer than were people who did not use the devices.

Researchers looked at the medical records and interviewed 1436 people. Of these, 896 had basil cell or squamous cell skin cancer. The other 540 people did not have either cancer.

Among the skin cancer patients, 190 reported using tanning devices at some time. Of those without skin cancer, only 75 had used tanning devices.

- a. What is the response variable? Is it categorical or numerical?

The response variable is whether or not a person had basil cell or squamous cell skin cancer. This is a categorical variable – yes or no.

- b. What is the explanatory variable? Is it categorical or numerical?

The explanatory variable is whether or not a person uses tanning devices. This is a categorical variable – yes or no.

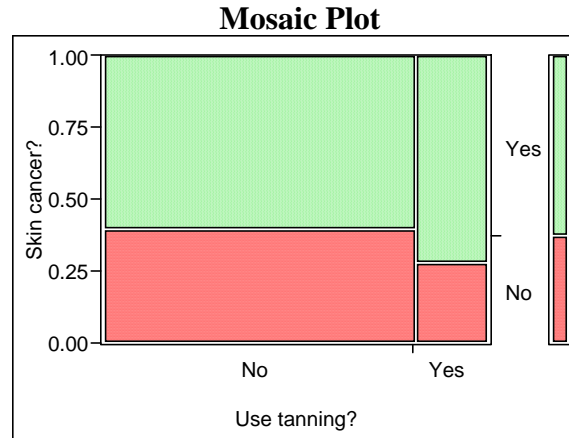
- c. Why is this study an observational study and not an experiment? Explain briefly.

This is an observational study because no treatment is imposed. The researchers are observing medical records and asking people about their use of tanning devices. There is no manipulated variable.

- d. Is this study a retrospective or prospective study? Explain briefly.

This is a retrospective study because researchers are looking at past medical records and past use of tanning devices.

- e. Below is a mosaic plot of the summarized data. Does this plot agree with the reported finding “that people who used tanning devices were 1.5 to 2.5 times more likely to have common kinds of skin cancer than were people who did not use the devices.”? Explain briefly.



No. For people who use tanning devices approximately 75% have skin cancer. For those who do not use tanning devices 60% have skin cancer. So people using tanning devices are more likely to have skin cancer but it is not 1.5 to 2.5 times as likely.

3. A FOX News/Opinion Dynamics Poll conducted September 15 – 16, 2009 asked 900 randomly selected registered voters in the U.S. “Do you support or oppose sending additional U.S. troops to Afghanistan?” 369 responded Support, 450 responded Oppose and 81 responded Unsure.

- a. What is the population?

The population consists of all registered voters in the U.S.

- b. What is the population parameter?

The population parameter is the proportion of all registered voters in the U.S. who support sending additional U.S. troops to Afghanistan.

- c. What is the sample?

The sample consists of the 900 people contacted by the FOX News/Opinion Dynamics Poll.

- d. What proportion of the sample supports sending additional U.S. troops to Afghanistan?

$369/900 = 0.41$ or 41% of the sample supports sending additional U.S. troops to Afghanistan.

- e. Is the proportion in d. a statistic or a parameter? Explain.

The proportion in d. is a statistic because it is a summary of the sample of 900 registered U.S. voters.

- f. What is the margin of error for this poll?

The margin of error for this poll is approximately

$$\pm \frac{1}{\sqrt{n}} = \pm \frac{1}{\sqrt{900}} = \pm 0.033.$$

- g. Given the margin of error, does a majority of the registered voters in the U.S. support sending additional U.S. troops to Afghanistan? Explain briefly.

No. Between 37.7% and 44.3% of all registered voters in the U.S. would support sending additional U.S. troops to Afghanistan. This is less than 50% so less than a majority.

4. The following is excerpted from an article that appeared in the January 21, 2007 Des Moines Register.

Broccoli, tomatoes work better together.

Broccoli and tomatoes – two vegetables known to help fight cancer – are more effective against prostate cancer if they're eaten together as part of a daily diet than if they're eaten alone, a new study with rats suggests.

Researchers fed a diet containing 10% broccoli powder and 10% tomato powder to a group of rats that had been implanted with prostate cancer cells. Another group of rats received only the 10% broccoli powder while a third group of rats received only the 10% tomato powder.

After 22 weeks, the researchers found that the combined broccoli/tomato diet was the most effective in reducing the prostate cancer (measured as % reduction in prostate tumor size).

- a. Why is this study an experiment and not an observational study? Explain briefly.

This is an experiment because the diet (treatment) was imposed on the rats. The content of the diet was manipulated by the researcher.

- b. Identify the response variable. What type of variable is this? Qualitative/Categorical or Quantitative/Numerical?

The response variable is the % reduction in prostate tumor size. This is a numerical variable.

c. What are the treatments? Be specific.

The treatments are diets containing:

- **10% broccoli and 10% tomato powder**
- **10% broccoli powder**
- **10% tomato powder**

d. Is there a control group in this experiment? Explain briefly.

No. A control group would be another set of rats that got a diet that contained no broccoli powder and no tomato powder.

e. Suppose the study involved 30 rats with implanted prostate cancer cells. Each rat is identifiable by a 2-digit number, 01 to 30, on an ear tag. The ear tag numbers are related to age, so that 01 is the youngest rat and 30 is the oldest rat. Explain how you would assign rats to the various diet groups. Be specific. Actually do the assignment and include a list of the ear tag numbers of the rats in each of the diet groups.

Rats should be assigned randomly to the treatment groups. To do this, use a random number table. Reading across and picking off 2-digit numbers as you go. The first 10 unique 2-digit numbers, no repeats, between 01 and 30 correspond to rats assigned to the 10% broccoli and 10% tomato diet group. The next 10 unique 2-digit numbers, no repeats, of the remaining numbers correspond to rats assigned to the 10% broccoli diet group. There should be 10 2-digit numbers remaining, those rats are assigned to the 10% tomato diet group.

Starting with row 3 of the Table of Random Numbers and reading from right to left until the end of the row and then going to the next row down.

| 10% broccoli and 10% tomato | 10% broccoli | 10% tomato |
|----------------------------------------|---------------------|-------------------|
| 24 | 07 | 01 |
| 13 | 05 | 02 |
| 04 | 03 | 08 |
| 22 | 12 | 09 |
| 09 | 19 | 14 |
| 15 | 10 | 20 |
| 17 | 11 | 21 |
| 30 | 27 | 23 |
| 16 | 18 | 25 |
| 06 | 29 | 26 |