Problem Set 8

Confidence Intervals and Decision Errors

1. **Chronic illness.** In 2013, the Pew Research Foundation reported that "45% of U.S. adults report that they live with one or more chronic conditions." However, this value was based on a sample, so it may not be a perfect estimate for the population parameter of interest on its own. The study reported a standard error of about 1.2%, and a normal model may reasonably be used in this setting.

    a. Create a 95% confidence interval for the proportion of U.S. adults who live with one or more chronic conditions. Also interpret the confidence interval in the context of the study. (Pew Research Center 2013)

    b. Identify each of the following statements as true or false. Provide an explanation to justify each of your answers.

        i. We can say with certainty that the confidence interval from part (a) contains the true percentage of U.S. adults who suffer from a chronic illness.

        ii. If we repeated this study 1,000 times and constructed a 95% confidence interval for each study, then approximately 950 of those confidence intervals would contain the true fraction of U.S. adults who suffer from chronic illnesses.

        iii. The poll provides statistically significant evidence (at the $\alpha = 0.05$ level) that the percentage of U.S. adults who suffer from chronic illnesses is below 50%.

        iv. Since the standard error is 1.2%, only 1.2% of people in the study communicated uncertainty about their answer.

2. **Testing for Fibromyalgia.** A patient named Diana was diagnosed with Fibromyalgia, a long-term syndrome of body pain, and was prescribed anti-depressants. Being the skeptic that she is, Diana didn't initially believe that anti-depressants would help her symptoms. However after a couple months of being on the medication she decides that the anti-depressants are working, because she feels like her symptoms are in fact getting better.

    a. Write the hypotheses in words for Diana's skeptical position when she started taking the anti-depressants.

    b. What is a Type 1 Error in this context?

    c. What is a Type 2 Error in this context?

3. ***Testing for food safety.** A food safety inspector is called upon to investigate a restaurant with a few customer reports of poor sanitation practices. The food safety inspector uses a hypothesis testing framework to evaluate whether regulations are not being met. If he decides the restaurant is in gross violation, its license to serve food will be revoked.

    a. Write the hypotheses in words.

    b. What is a Type 1 Error in this context?

    c. What is a Type 2 Error in this context?

    d. Which error is more problematic for the restaurant owner? Why?

    e. Which error is more problematic for the diners? Why?

f. As a diner, would you prefer that the food safety inspector requires strong evidence or very strong evidence of health concerns before revoking a restaurant's license? Explain your reasoning.

Pew Research Center. 2013. https://www.openintro.org/go?id=textbook-pew-2013-diagnosis-difference.