Statistics 10 Lecture 16 More about Hypothesis testing (Chapter 21 pp. 389-396)

1. Last Time (Chapter 20)

This is the basic idea in Chapter 20: we make assumptions about the unknown parameters, and then test to see if those assumptions could have led to the outcomes (statistics) we actually observe. We then use a probability calculation to express the strength of our conclusions, stated as a chance (probability) and not as a confidence interval (even though the parameter is unknown).

We learned that hypothesis testing has a number of "steps"

a. State a Null Hypothesis – it suggests that any deviations from the parameter are just due to chance
b. State an Alternative – this is usually what a research is setting out to prove. It suggests that deviations from the parameter are not due to chance but that the value give to the parameter is not correct.
c. Perform a Test – this is a "Z" test and it is interpreted as the number of standard deviations (of the sampling distribution) the particular sample outcome is from the parameter.
d. Find the p-value (probability value) – using the Z score that resulted from the test, look up the "tail" area of the normal distribution.

2. P-VALUE (probability value)

This is the chance (probability) of getting results (Z) as or more extreme than what we got, IF the null hypothesis were true.

P-VALUES could also be called "observed significance levels" and it is simply the "tail" area associated with the Z score calculated using the sample information and parameter information.

p-values can be interpreted as "if-then" statements:
"If the null hypothesis were true, then there would be a p% chance of getting these kind of results from a single sample."

The less probable an outcome is, the stronger the evidence that we would reject the null in favor of the alternative.

Example: If instead you had gotten a sample proportion of .51 with the same standard deviation, there would not be enough evidence to make the claim that marijuana helps MS sufferers. (A Z of about .80 has about 21% of the area under the normal curve, so here, there was a 21% chance of getting a sample with 51% or more showing pain relief). The p-value is NOT the probability that the null is false, it is not the probability that it is true either.

3. ALPHA LEVELS & STATISTICAL SIGNIFICANCE

When a p-value is small, this suggests that our sample statistic was rare GIVEN the null hypothesis.

We arbitrarily determine what is rare. If a sample statistic has a p-value below some threshold called an ALPHA LEVEL, we consider it "rare" and rare results are called "STATISTICALLY SIGNIFICANT"

Alpha levels are typically .01, .05 and .10 and it's symbol is α.. An alpha level of .05 is usually the most commonly used.

In our example in the last lecture, the p-value was less than .05 and if our alpha level was .05 we would conclude that that the marijuana treatment of persons with MS was statistically significant. This means that you have sufficient evidence to REJECT THE NULL (we don't say accept) in favor of the ALTERNATIVE HYPOTHESIS and this suggests that the patients using marijuana are experience more pain relief that patients on more traditional treatments.

4. Thinking about statistical significance

a. All it means is that the p-value you got was smaller than some arbitrarily set alpha level
b. It does not necessary mean important
c. It does not mean the null is wrong (that's called a TYPE I error – we reject a true null)
d. A large sample size can make the tiniest difference statistically significant