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0415 Live Unit 4A Summary

Slide 44: And the first one actually is back to the proportion problem. We did this with the confidence interval but what we have here again is the obesity percentage in the ER was 38.4 percent. From the data we had a confidence interval that ran from 33.9 to 43.0. So before we were trying to compare to Florida, 26.6 and we said clearly its way larger than that, so we're going to reject the null hypothesis. It's bigger than 26.6 percent. A higher proportion of the ER patients who are obese than the Florida overall rate.

Slide 45: We want to do the hypothesis test here. So I just wanted to set it up for you. My hypothesis is that p is equal to 0.266 verses in the ER its greater than 0.266. I'm just plugging in my numbers from there. 0.384 was my estimate from my data 0.384 minus 0.266 over, plugging in p-zero, 0.266, the total sample size was 437. I get a z-score of 5.58. I don't even need the p-value. I don't even care what the p-value is until somebody makes me tell you what the p-value is. But basically nothing if I look it up. The obesity rate in the ER is statistically significantly higher than the overall rate in Florida. We might say it that way as our conclusion. No matter what significance level we pick, 0.01, 0.001, doesn't matter, it's tiny.

Slide 47: Example 2: An agricultural company interested in reducing the time needed to harvest its crops hired a mechanical engineer to design a mechanical harvester for bell peppers. To heighten the precision and his machine he measures and records the angle at which the peppers hang on the plant. Perform a one-sample test to determine whether the data gives good evidence that peppers hang on plants at an angle of any kind, just different from zero. I've got the Excel dataset and the CSV dataset posted here in case you actually want to run this data yourself as we learn how to do this kind of stuff.

Slide 48: Here's our analysis. The hypotheses we're setting up are that mu is zero, the mean angle at which peppers hang on a plant is zero versus it's not zero and then Steps 2&3, we're going to let the software do this and I have all the output from both software packages, you are more than welcome to look through it, and you should, to make sure that you know what's going on. The p-value was 0.0037 so we're going to reject the null hypothesis.

The question is well, what angle are peppers hanging on the plant. Well the mean angle, which really is not necessarily helpful here, right? If I have to pick all the peppers I need a machine that can handle the whole range of angles that they might actually hang at but the mean angle is somewhere between, with 95 percent confidence, 1.12 degrees off zero to 5.23 degrees off zero and so very exciting. The mean angle at which peppers hang on the plant is significantly different from zero.

Slide 49: And then we're going to do, this is actually the start of case CQ. I'm going to motivate where we're going to be heading by doing what I can do today and we'll talk more about the case CQ components in lecture but right now we're just going to cover this example.

So this is an example about drinking and driving. A sample of 20 drivers were chosen and their reaction times on an obstacle course were measured before and after drinking two beers. The purpose of the study was to check whether drivers are impaired after drinking two beers.

The measurements are paired. There are two variables. We have your time on the course before. We have your time on the course after. If you were impaired, what do I expect to happen to your time on the obstacle course? It's going to increase. So the solution to our problem of dependent paired measurements is that what we're going to do and the reason this fits here is, we're just going to reduce it to one sample by saying, what's the difference in your time? How much longer did it take you the second time around?

So we're really going to take what used to be two measurements and turn them into one measurement that reflects what I actually want to study, your impairment level. So even though we start with what seems like two variables, before and after, because they are paired we're going to reduce that.

Now this doesn't work with every pairing, if I have your height and your weight, yeah they are paired but subtracting them doesn't make any sense, right? So then that's a scatter plot and a regression line and all that stuff. So sometimes to quantitative variables that are dependent, it's what we want, it's a scatterplot. But now we're saying, we can't just compare the two groups because we know there's a connection between those two groups. We need to take the differences first.

Slide 50: So this is our picture, we have before two beers, after two beers. We want to look at the difference in your reaction times. We know that the people are paired because it's the same person driving this twice.

Slide 51: So I have these 20 drivers, they're paired. What we started out with is the before and the after. What we're going to end with is just these differences. Now which way you want to take the difference is totally up to you. Can be before minus after or after minus before, but what impairment means, changes. But here, big numbers after are going to translate into negative so we actually had four people who did worse the second time around and one person who did one second better the second time around. Notice, we're only seeing five, so we're not knowing what happened with the other 15 measurements in the middle so we can't really make an assumption yet about what we see. That's the idea.

Slide 52: We are going to take those differences, in either way that we want, and then we're going to set up our hypotheses. The notation here is changing a little bit but it's so that you'll keep in mind it's a pair difference problem. So we say "mu sub d" the mean difference. You can just write mu as long as you define mu to be the mean difference, that's fine with me. But the notation here is just to keep your brain on what kind of problem you're on. So the mean difference is zero versus it's less than zero, greater than zero, or not equal to zero.

Normally we are comparing to nothing. There's a change versus there's no change but sometimes we actually might want that change to be a certain amount. It's at least five units and then that zero might be a five. That number doesn't have to be zero; you can want a specific change, at least five units different after the beer. But here we are just saying is there any impairment at all. And then we would do our test statistic the same. The mean of the differences, since my null value is zero, I get the plug in a zero there. The standard deviation of the differences divided by the square root of n to get our t-score.

Slide 53: We're not going to really be doing this by-hand. The test statistic works out to be negative 2.58, the p-value works out to be 0.009 and so the data do provide enough evidence to reject the null hypothesis and conclude that two beers does slow reaction times of drivers.

Slide 55: So the confidence interval is roughly between a 0.1 second increase to a 0.9 seconds increase. Somewhere in that range.

Slide 54 (and 53): In the output you'll notice that you'll see a two-sided p-value there but this was a one-sided test so when I calculated that p-value here of 0.009. When you look in the output you are likely to see 0.018, twice that p-value. So I had to take half the p-value that was given and then convince myself that that was the right answer because my data do indeed provide evidence of impairment not that I got better after drinking two beers, right?

Again, if my data show that I got better at driving after drinking two beers, well I don't need to find the p-value to know that I can't reject my (null) hypothesis, so just make sure that at the very last step you look back at your data and ask yourself if this conclusion that you wrote makes any sense at all given the data you have and if it does not then you will catch yourself and you will say OOPS somehow I managed to get this all backwards.

You have to be careful when converting to a one-sided p-value we mentioned that earlier if the data are in the direction of our alternative then we just take half of the two-sided p-value but if the data are not in the direction then the correct p-value is very large and is actually the compliment of half, one minus half the two-sided p-value. But you will always know whether you made the right choice or not by looking back to your data and say, I said it was greater but my data were less OOPS that was not the right decision obviously.

So always you can have an idea when you start but be careful about having too much of an idea when you start because again we're giving you a lot of stuff that's borderline. You might think you have enough evidence but you don't or you might not think you have enough evidence but you do once you come around to calculating that p-value.