⚠ Lagunita is retiring and will shut down at 12 noon Pacific Time on March 31, 2020. A few courses may be open for self-enrollment for a limited time. We will continue to offer courses on other online learning platforms; visit http://online.stanford.edu.

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Wrap-Up (Hypothesis Testing Overview)

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Wrap-Up (Hypothesis Testing Overview)

Learning Objective: Explain the logic behind and the process of hypotheses testing. In particular, explain what the p-value is and how it is used to draw conclusions.

Let's Summarize

We learned quite a lot about hypothesis testing. We learned the logic behind it, what the key elements are, and what types of conclusions we can and cannot draw in hypothesis testing. Here is a quick recap:

Hypothesis Testing
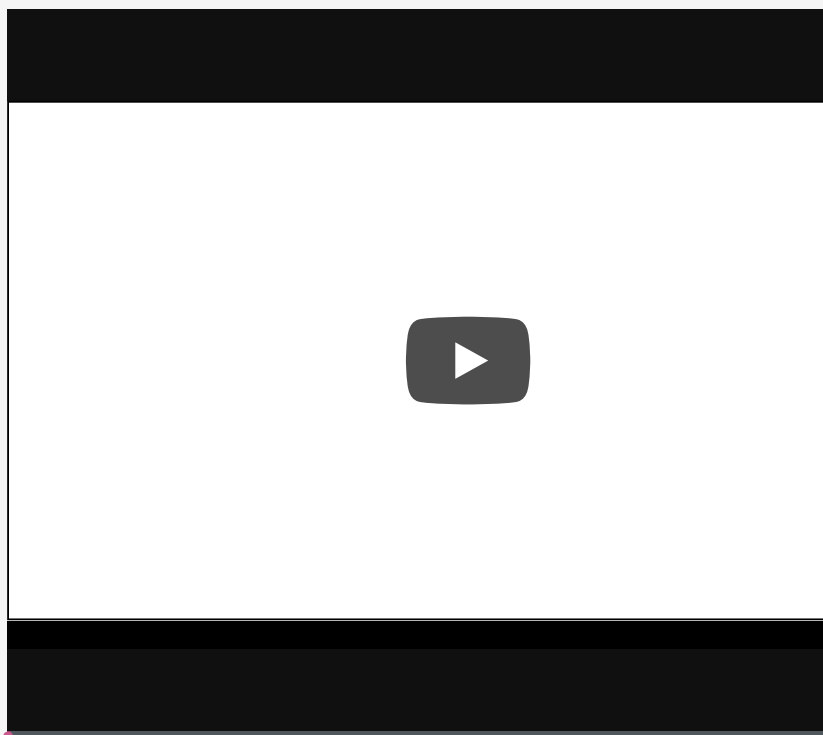
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In hypothesis testing, we have two claims about the population which we call the

null hypothesis, Ho, and the alternative hypothesis, Ha. The alternative hypothesis

challenges the null hypothesis and represents what we want to check - or what we

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suspect might be true.

Our goal is to decide whether we

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Scenario: Smoking and Low Birth Weight Babies

Background: Based on the National Center of Health Statistics, the proportion of babies born at low birth weight (below 2,500 grams) in the United States is roughly 0.078, or 7.8% (based on all the births in the United States in the year 2002). A study was done in order to check whether smoking by pregnant women increases the risk of low birth weight. In other words, the researchers wanted to check whether the proportion of babies born at low birth weight among women who smoked during their pregnancy is higher than the proportion in the general population. The researchers followed a sample of 400 women who had smoked during their pregnancy and recorded the birth weight of the newborns. Based on the data, the p-value was found to be 0.016.

Did I Get This (1/1 point)

Write down the null and alternative hypotheses (Ho and Ha) that are being tested here.

Your Answer:

Ho = Smoking by pregnant women does not increase the risk of low birth weight
Ha = Smoking by pregnant women increases the risk of low birth weight

Our Answer:

We are testing: Ho: The proportion of low birth weight births among women who smoke during the pregnancy is 0.078 (same as in the general population). Ha: The proportion of low birth weight births among women who smoke during the pregnancy is higher than 0.078. Recall that as we learned, the null hypothesis (Ho) says that "nothing special is going on" or there is no change from the known proportion of 0.078. The alternative hypothesis (Ha) challenges Ho and represents what the study wanted to check.

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Did I Get This (1/1 point)

Based on the p-value, what is your conclusion (use a 0.05 significance level)?

Your Answer:

Since p-value is lower than 0.05, we can reject the null hypothesis and accept the alternative: smoking really increases risk of low birth weight because low p-value means it'll be very unlikely to observe that the null hypothesis was true.

Our Answer:

The p-value of the test is 0.016, which means that it is very unlikely (probability of 0.016) that we will observe data like those observed if indeed smoking does not increase the risk of low birth weight (Ho is true). In particular, since the p-value is less than 0.05, we conclude that the data provide enough evidence to conclude that the proportion of low birth weight babies born to mothers who smoked during their pregnancy is higher than the overall proportion of low birth weight babies in the population.

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Scenario: Second-Hand Smoking and Low Birth Weight Babies

The same researchers also wanted to examine whether second-hand smoking (exposure to a another person smoking) by pregnant women increases the risk of low birth weight (i.e., the proportion of babies born at a low birth weight among women who were second-hand smokers during their pregnancy is higher than the proportion in the general population). The researchers obtained a sample of 175 pregnant women who were second-hand smokers, followed them during their pregnancies, and found that 10.2% of the newborns had low birth weight. Based on these data, the p-value was found to be 0.119.

Did I Get This (1/1 point)

Write down the null and alternative hypotheses (Ho and Ha) that are being tested here.

Your Answer:

Ho = second-hand smoking does not increase the risk of low birth weight (also 10.2%)
Ha = second-hand smoking does increase the risk of low birth weight (higher than 10.2%)

Our Answer:

We are testing: Ho: The proportion of low birth weight births among women who are second-hand smokers is 0.078 (same as in the general population). Ha: The proportion of low birth weight births

among women who are second-hand smokers is higher than 0.078. Recall that as we learned, the null hypothesis (Ho) says that "nothing special is going on" or there is no change from the known proportion of 0.078. The alternative hypothesis (Ha) challenges Ho and represents what the study wanted to check.

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Did I Get This (1/1 point)

Based on the p-value, what is your conclusion (use .05 significance level)?

Your Answer:

> There is not enough evidence to reject Ho. The p-value of 0.119 means that it is not unlikely that the population data would be similar to that sampled

Our Answer:
The p-value of this test was found to be .119, which means that it is not extremely unlikely (roughly 12% chance) that we would get data like those observed if, indeed, second-hand smoking does not increase the risk of low birth weight (Ho is true). In particular, since the p-value is not less than .05, we conclude that the data do not provide enough evidence to conclude that second-hand smoking increases the risk of low birth weight.

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Did I Get This (1/1 point)

Can we conclude that the results of this study provide evidence that second-hand smoking does not increase the risk of low birth weight?

Your Answer:

> no

Our Answer:
No. Recall that in hypothesis testing we can never conclude that we accept Ho (or that Ho is true). All we can say (in case we do not get a small p-value) is that we do not have enough evidence to reject Ho. In particular in this case we found that 10.2% of the 175 newborns were at low birth weight (which is higher than 7.8%, the overall proportion). While this result did not provide enough evidence to conclude that second-hand smoking increases the risk of low lightweight, it definitely does not provide evidence that it doesn't. (which is what Ho claims).

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