Stat Support Activity: Hypothesis Test Conclusions

Notes: Steps to writing Conclusions

Step 1: Address the Claim

If the null hypothesis (H_0) is the claim: *There are two possibilities.*

- Yes, we have evidence to reject the claim
  OR
- No, we do not have evidence to reject the claim.

If the alternative hypothesis (H_A) is the claim: *There are two possibilities.*

- Yes, we have evidence to support the claim
  OR
- No, we do not have evidence to support the claim.

Step 2: Address the evidence (Yes or No)

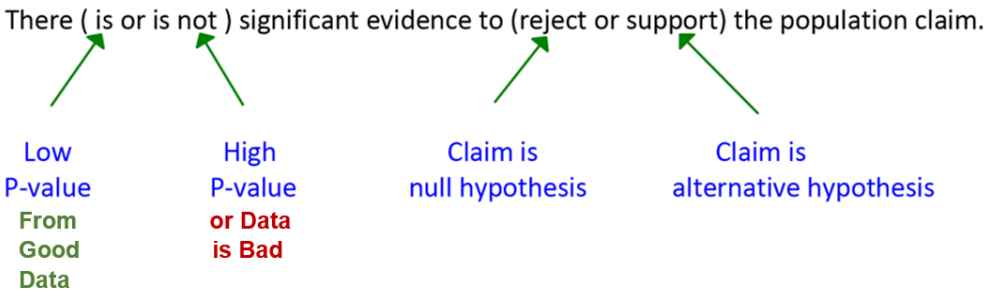
- **Low P-value** *(less than significance level)*
  from Good Data: We have significant evidence.

- **Low P-value** *(less than significance level)*
  from Bad Data: We do NOT have significant evidence.

- **High P-value** *(higher than significance level)*
  from Good or Bad data: We do NOT have significant evidence.

Step 3: Write the conclusion sentence

Remember a low P-value is considered significant statistical evidence but a high P-value is not evidence. When the claim is H_0, we will either be rejecting or not rejecting the claim. When the claim is H_A, we will either be supporting or not supporting the claim.



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Notice there are 4 Possible Conclusions.

- If the claim is H_0 , P-value from good data is low *(Think "Yes Evidence Reject")*
  Conclusion Sentence: **There <u>is</u> significant evidence to <u>reject</u> the claim.**
  (Data indicates that the null hypothesis is wrong and the null hypothesis is the population claim. So we thing the population claim is wrong and we have evidence.)

- If the claim is H_0 , P-value is high or data is bad *(Think "No Evidence Reject")*
  Conclusion Sentence: **There is <u>not</u> significant evidence to <u>reject</u> the claim.**
  (You cannot tell if the null hypothesis is wrong and the null hypothesis was the population claim. Data is inconclusive or bad. You cannot tell if the population claim is wrong.)

- If the claim is H_A , P-value from good data is low *(Think "Yes Evidence Support")*
  Conclusion Sentence: **There <u>is</u> significant evidence to <u>support</u> the claim.**
  (Data indicates that the null hypothesis is wrong and the alternative hypothesis is correct. Since the alternative hypothesis is the population claim, we thing the population claim is correct and we have evidence.)

- If the claim is H_A , P-value is high or data is bad *(Think "No Evidence Support")*
  Conclusion Sentence: **There is <u>not</u> significant evidence to <u>support</u> the claim.**
  (You cannot tell if the alternative hypothesis is correct and the alternative hypothesis was the population claim. Data is inconclusive or bad. You cannot tell if the claim is correct.)

<u>Step 4: Explain the conclusion sentence</u>

Our job as data scientists, statisticians and data analysists is to explain. People rarely understand the language and difficult ideas in statistics. The conclusion is a summary of the hypothesis test, but is rarely understood. It is always good to explain the conclusion in plain language. Here is a summary table to help.

Hypothesis Test Conclusion Table

	Reject Ho or Fail to reject Ho?	Conclusion if Claim is Null Hypothesis (Ho)	Conclusion if Claim is Alternative Hypothesis (Ha)	Explain: What does the hypothesis test tell us?
HIGH P-VALUE + GOOD DATA (P-value higher than the significance level AND random sample data DOES meet the conditions / assumptions for the hypothesis test and is relatively unbiased.)	Fail to Reject Ho	There is NOT significant evidence to REJECT the claim that …	There is NOT significant evidence to SUPPORT the claim that…	**Sample Statistic from good unbiased random sample data does NOT significantly disagree with the null hypothesis and so cannot support the alternative hypothesis.**
HIGH P-VALUE + BAD DATA (P-value higher than significance level BUT the data does NOT meet the conditions / assumptions for the hypothesis test OR has other sources of bias.)	Fail to Reject Ho	There is NOT significant evidence to REJECT the claim that …	There is NOT significant evidence to SUPPORT the claim that…	**Sample Statistic from bad biased sample data does NOT significantly disagree with null hypothesis.** P-values calculated from bad biased data should not be taken as evidence to make decisions about a population claim.
LOW P-VALUE + GOOD DATA (Low P-value AND random sample data DOES meet the conditions / assumptions for the hypothesis test and is relatively unbiased.)	Reject Ho	There IS significant evidence to REJECT the claim that…	There IS significant evidence to SUPPORT the claim that…	**Sample Statistic from good unbiased random sample data significantly disagrees with the null hypothesis and supports the alternative hypothesis.**
LOW P-VALUE + BAD DATA (P-value lower than significance level BUT the data does NOT meet the conditions / assumptions for the hypothesis test OR has other sources of bias.)	Fail to Reject Ho	There is NOT significant evidence to REJECT the claim that …	There is NOT significant evidence to SUPPORT the claim that…	**Sample Statistic from bad biased sample data significantly disagrees with null hypothesis.** P-values calculated from bad biased data should not be taken as evidence to make decisions about a population claim.

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Conclusion Problems

Problem Directions: Answer the following conclusion questions and fill out the table.

	P-value	Data	Claim	Significant Evidence? (Yes or No)	Reject Ho or Fail to reject Ho?	Formal Conclusion Sentence
1.	Higher than α	Good	H_0			
2.	Lower than α	Bad	H_A			
3.	Higher than α	Bad	H_A			
4.	Lower than α	Good	H_0			
5.	Higher than α	Bad	H_0			
6.	Lower than α	Good	H_A			
7.	Lower than α	Bad	H_0			
8.	Higher than α	Good	H_A			

	P-value	Data	Claim	Significant Evidence? (Yes or No)	Reject Ho or Fail to reject Ho?	Formal Conclusion Sentence
9.	Higher than α	Bad	H_A			
10.	Lower than α	Good	H_0			
11.	Higher than α	Good	H_0			
12.	Lower than α	Bad	H_A			
13.	Higher than α	Good	H_A			
14.	Lower than α	Bad	H_0			
15.	Lower than α	Good	H_A			
16.	Higher than α	Bad	H_0			