Hypothesis Test Notes: Conclusions

A conclusion is a final statement about the hypothesis test that addresses evidence and the claim. What can I tell the person about their claim about the population? How much evidence do I have to back up what I am saying?

Important Note: "Reject H_0" or "Fail to reject H_0" is NOT a conclusion. This is a simple statement of what the P-value tells us about the null hypothesis. It does not address evidence and the claim.

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)

So how do we know if it is a Yes (evidence) or No (no evidence)?

P-value to the rescue!!!

Remember a low P-value close to zero (lower than the significance level) rules out sampling variability and tells us the sample data is significant. A high P-value not close to zero (higher than the significance level) tells us sampling variability may be involved and the sample data is not significant.

Low P-value (close to zero): Yes!! We have evidence.

High P-value (not close to zero): No. We do NOT have evidence.

Step 3: Write the conclusion sentence

"There (*is or is not*) significant evidence to (*reject or support*) the claim."

Example 1

A nursing magazine recently claimed that the population mean average amount of a particular medicine that is being given to patients is about 100 milligrams. Looking at a large random sample, we found a P-value of 0.0041 and a 5% significance level ($\alpha = 0.05$) was used in the study. Assuming the data met all the assumptions, what would be the conclusion?

H_0: μ = 100 milligrams (Claim)
H_A: $\mu \neq$ 100 milligrams

Step 1: Address the Claim

The claim is H_0, so there are two possible conclusions.

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

Step 2: Address the Evidence (Yes or No)

The P-value = 0.0041 = 0.41% is less than the 5% significance level. So this is a low P-value close to zero. This rules out sampling variability (random chance) and tells us the sample data significantly disagrees with the null hypothesis. We would reject the null hypothesis. Since the claim is the null hypothesis, we have evidence to reject the claim. (YES!!)

Step 3: Writing the conclusion sentence:

"There (*is or is not*) significant evidence to (*reject or support*) the claim."

This is a Yes Reject situation.

Formal Statistics Conclusion:
There is significant evidence to reject the claim that the mean average amount of this medicine being given to patients is 100 mg.

What does this conclusion mean in plain language?

It is not true that the population mean average is 100 mg
and we have evidence to back up what we are saying.

Example 2

An online article is currently estimating that more than 35% of people in the U.S. voted in the last election. Looking at a large random sample, we found a P-value of 0.267 and a 10% significance level ($\alpha = 0.10$) was used in the study. Assuming the data met all the assumptions, what would be the conclusion?

H_0: $p \leq 0.35$
H_A: $p > 0.35$ (claim)

Step 1: Address the Claim

The claim is H_A, so there are two possible conclusions.

- 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)

The P-value = 0.267 = 26.7% is more than the 10% significance level. So this is a high P-value and is not close to zero. This data could have happened because of sampling variability (random chance) and tells us the sample data does not significantly disagrees with the null hypothesis. We would fail to reject the null hypothesis. We do not have evidence to reject the null hypothesis. You have to reject the null hypothesis to be able to support the alternative hypothesis. So we do not have evidence to support the claim. (NO!!)

Step 3: Writing the conclusion sentence:

"There (*is or is not*) significant evidence to (*reject or support*) the claim."

This is a No Support situation.

Formal Statistics Conclusion:
There is not significant evidence to support the claim that more than 35% of people in the U.S. voted in the last election.

What does this conclusion mean in plain language?

It may be true that more than 35% voted, but we do not have evidence to back up that claim.

Conclusion Summary (4 Possible Conclusions)

If the claim is H_0 , P-value is low *(Think "Yes Evidence Reject")*
Conclusion Sentence: There is significant evidence to reject the claim.
(You are rejecting the null hypothesis and the null hypothesis is the claim.)

If the claim is H_0 , P-value is high *(Think "No Evidence Reject")*
Conclusion Sentence: There is not significant evidence to reject the claim.
(You do *not* have evidence to reject the null hypothesis and the null hypothesis is the claim.)

If the claim is H_A , P-value is low *(Think "Yes Evidence Support")*
Conclusion Sentence: There is significant evidence to support the claim.
(You are rejecting the null hypothesis which means you think the alternative hypothesis is correct and the alternative hypothesis is the claim.)

If the claim is H_A , P-value is high *(Think "No Evidence Support")*
Conclusion Sentence: There is not significant evidence to support the claim.
(You do not have evidence to reject the null hypothesis which means you do not know if the alternative hypothesis is correct and the alternative hypothesis is the claim.)