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Hypothesis Testing for the Population Mean: Drawing Conclusions

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Hypothesis Testing for the Population Mean: Drawing Conclusions

Learning Objective: Carry out hypothesis testing for the population proportion and mean (when appropriate), and draw conclusions in context.

So far, we've discussed the first three steps in the hypothesis testing process of the z-test for the population mean (μ). The last step is to draw conclusions.
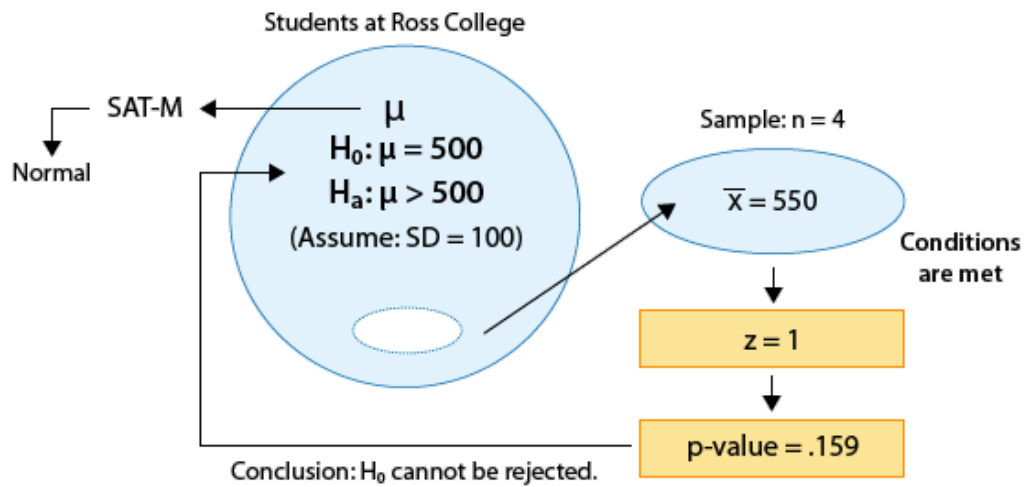
4. Drawing Conclusions

Here we assess the significance of the results (based on the p-value compared with some significance level of choice), and state our conclusions in context.

> **Example: 1**

Here the p-value is quite large (0.16) which means that it is not very surprising to get data like those observed when H_o is true. The results are therefore not significant, and so we do not have enough evidence to reject H_o and conclude that the mean SAT-M of all Ross College students is higher than the national mean (500).

Note that even though the average SAT-M in our sample was 550 (which is substantially larger than 500), since this result was based on a sample of only 4 students, it does not provide enough evidence to conclude that the mean SAT-M is higher than 500. We'll further explore this point in the next activity. Here is the completed figure representing the hypothesis testing process for this example:
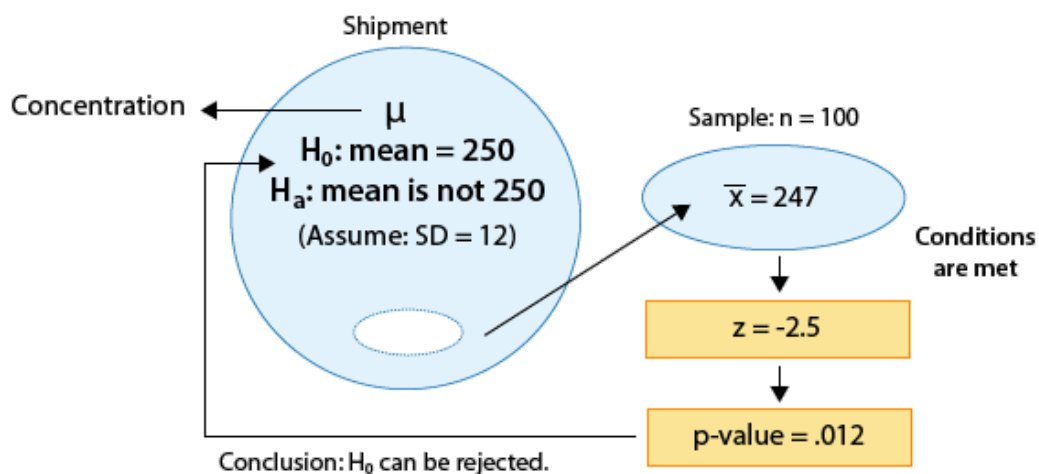
Students at Ross College

SAT-M

Normal

μ

$H_0: \mu = 500$

$H_a: \mu > 500$

(Assume: SD = 100)

Sample: n = 4

$\overline{X} = 550$

Conditions are met

z = 1

p-value = .159

Conclusion: H_0 cannot be rejected.

Example: 2

In this example, the p-value is quite small (0.012). In particular, for a significance level of 0.05, the p-value indicates that the results are significant.

The data provide enough evidence for us to reject H_o and conclude that the mean concentration level in the shipment is not the required 250 ppm.

Here is the completed figure representing the hypothesis testing process for this example:

Shipment

Concentration

μ

$H_0: \text{mean} = 250$

$H_a: \text{mean is not } 250$

(Assume: SD = 12)

Sample: n = 100

$\overline{X} = 247$

Conditions are met

z = -2.5

p-value = .012

Conclusion: H_0 can be rejected.

Scenario: SAT Math Scores

The purpose of this activity is teach you to run the z-test for the population mean while exploring the effect of sample size on the significance of the results.

Background:

Recall example 1 that we've just completed:
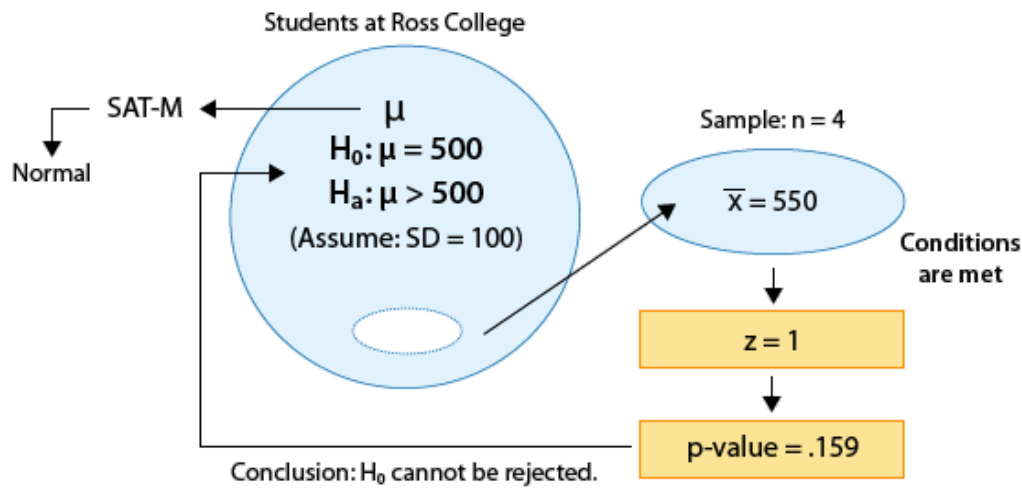
Even though the sample mean was 550, which is substantially greater than the null value, 500, this result was not significant, since it was based on data obtained from only 4 students. In other words, the data did not provide enough evidence to reject H_o and conclude that the mean SAT-M score of all Ross College students is larger than 500, the national mean. If this sample mean were obtained from 5 students, would that result be significant? If not, would 6 be enough? In other words, what is the smallest sample size for which a sample of $\bar{x} = 550$ would be significant? In this activity, we will use statistical software to explore this question.

Comment: If you think about it, this question is not very practical, because you do not know in advance what the sample mean will be, but it is intuitive enough that it will help you get a better sense of how the sample size affects the significance of the results.

Learn By Doing (1/1 point)

Before we do any kind of analysis, what do you think should be the smallest sample size for which a sample mean SAT-M of 550 would be enough evidence to reject Ho and conclude that μ is greater than 500? Use your intuition and personal feelings. There is no right or wrong answer here.

Your Answer:

10?

Edit: OH SHIT I GOT 10, NICE

Our Answer:

There is no right or wrong answer here. Our guess would be n = 10.

[Resubmit]   [Reset]

For n = 4, we know that the result $\bar{x}$ = 550 is not significant. Using statistical software we test the significance of the z-test under different sample size scenarios, n = 5 to n = 15.

Sample Sizes Needed for Significance

n	z (test statistic)	p-value	Signficant at 0.05? (Yes/No)
5	1.12	0.132	No
6	1.22	0.110	No
7	1.32	0.093	No
8	1.41	0.079	No
9	1.50	0.067	No
10	1.58	0.057	No
11	1.66	0.049	Yes
12	1.73	0.041	Yes
13	1.80	0.036	Yes
14	1.87	0.030	Yes
15	1.94	0.026	Yes

Learn By Doing (1/1 point)

Was your guess about right?

Your Answer:

Almost.

Edit: OH SHIT I ALSO SAID ALMOST

Our Answer:
For a sample mean of 550 to be a significant result, it needs to be obtained from a sample of size at least 11. Our guess of n = 10 was "almost" correct.

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