Monday, February 11, 2019

- **Warm-up**

  $\hat{p} = \frac{25}{725} = 0.034$

  - **Out of 725 newborns, 25 have a gene that may be linked to juvenile diabetes. Calculate a 95% confidence interval for the percent of newborns in the population who have that gene.**

    1. **Calculate the standard error:** $\sqrt{\frac{\hat{p}\hat{q}}{n}} = \sqrt{\frac{(0.034)(0.965)}{725}}$

       $SE = 0.0067$

    2. **Use a critical z (z*) of 1.96 to calculate the Margin of Error (z* x SE)** $ME = 1.96 \cdot 0.0067 = 0.012$

    3. **Both add and subtract the ME from the** $\hat{p}$

       0.034 ± 0.012 or $(0.022, 0.046)$

- **Check Homework**
- **Confidence Intervals**

Objectives

- **Content Objective**: I will use the ideas in the previous chapter to discuss and calculate confidence intervals.
- **Social Objective**: I will listen and not disrupt class.
- **Language Objective**: I will take clear notes and ask understandable questions when I do not understand.

Wednesday’s worksheet

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What Does "95% Confidence" Really Mean?

Each confidence interval uses a sample statistic to estimate a population parameter.

But, since samples vary, the statistics we use, and thus the confidence intervals we construct, vary as well.

What Does "95% Confidence" Really Mean?

The figure to the right shows that some of our confidence intervals (from 20 random samples) capture the true proportion (the green horizontal line), while others do not:

What Does “95% Confidence” Really Mean?

Our confidence is in the ***process*** of constructing the interval, not in any one interval itself.

Thus, we expect 95% of all 95% confidence intervals to contain the true parameter that they are estimating.

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Margin of Error: Certainty vs. Precision

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Margin of Error: Certainty vs. Precision

90%

The choice of confidence level is somewhat arbitrary, but keep in mind this tension between certainty and precision when selecting your confidence level.

The most commonly chosen confidence levels are 90%, 95%, and 99% (but any percentage can be used).

99%

95%

BUT FIRST…

Assumptions and Conditions

Independence Assumption

Randomization

10% Condition

Sample × 10 < population

Sample Size Assumption

Success/Failure Condition

We must expect at least 10 "successes" and at least 10 "failures."

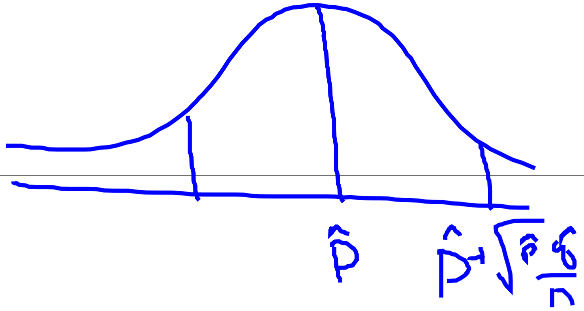
$$np \geq 10$$
$$nq \geq 10$$

if possible. use population proportions- if they are not available, use sample

State Your Model… Completely

- *Distribution*
- *Mean*
- *Standard Deviation*

$$N\left(\hat{p}, \sqrt{\frac{\hat{p}\hat{q}}{n}}\right)$$



- *You should also draw a picture*

How big does my sample need to be?

$$ME = z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

1. Choose a Margin of Error (ME) and a Confidence Interval Level.
2. The formula requires which we don't have yet because we have not taken the sample. A good estimate for $\hat{p}$, which will yield the largest value for $\hat{p}\hat{q}$ (and therefore for *n*) is 0.50.
3. Solve the formula for *n*.

According to recent Pew Research, 92% of teenagers report going online daily. How many people would I need to survey to validate that statistic for Northglenn High School students?

ME = 2%

Confidence Level: 95%

$$\frac{0.02}{1.96} = \frac{1.96\sqrt{\frac{(0.5)(0.5)}{n}}}{1.96}$$

$$(0.01)^2 = \left(\sqrt{\frac{(0.5)(0.5)}{n}}\right)^2$$

$$\frac{n \cdot 0.0001}{0.0001} = \frac{(0.5)(0.5)}{n} \cdot \frac{n}{0.0001}$$

$$n = 2401$$

$$ME = z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

* if decimal answer - **always** round up

$$\frac{ME}{z^*} = \frac{z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}}{z^*}$$

$$\left(\frac{ME}{z^*}\right)^2 = \left(\sqrt{\frac{\hat{p}\hat{q}}{n}}\right)^2$$

$$n = \frac{\hat{p}\hat{q}}{\left(\frac{ME}{z^*}\right)^2}$$

A 2009 Harris poll found that 33% of 2,681 Americans surveyed said they were "very happy." construct a 95% confidence interval for the percent of Americans who are "very happy."

Random not stated, but assumed

2681 × 10 < entire population of americans

$0.33 \times 2681 \geq 10$ sample size met

$0.67 \times 2681 \geq 10$

$x = (0.33)(2681) = 884.73$

Proceed with one proportion confidence interval

$$0.33 \pm \underbrace{1.96\sqrt{\frac{(0.33)(0.67)}{2681}}}_{0.0177}$$

I am 95% confident that the true proportion of "very happy" people is 33% ± 1.77%.

Homework
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