"What is Confidence?" Exercises

Suppose a researcher wants to know the prevalence of a certain genetic condition in the adult population. She draws a representative random sample of adults, and, of those, 12% have the condition she's interested in.

E1. If the margin of error (MOE) is 10% for this study, what is the 95% confidence interval (CI) for the prevalence of this condition in the population?

E2. Please explain what that interval from **E1** *means*!

E3. Suppose that, from historical records kept, this condition was believed to be prevalent in 5% of the adult population (you can assume this 5% is a parameter). Does the CI in **E1** give evidence that the percentage has changed?

E4. Suppose a similar study is done at another research institution, and they also arrive that the same condition percentage (12%). However, their MOE is 5%. What is the 95% CI for the prevalence of this condition in the population, based on these results?

E5. Refer back to **E3**. Does your CI from **E4** give evidence that the percentage has changed?

E6. Assuming both studies were done similarly, which of the two do you think had the larger sample size? Why?

E7. Why is a margin of error necessary (in either of these studies, or in any other study)?

Answers.

E1. 12% ± 10%, or (2%, 22%).

E2. On average, 95% of intervals formed from studies such as this one will contain the population percentage of the incidence of the condition you're interested in. Here's hoping hers is one of them!

E3. Nope. 5% is contained within the CI (2%, 22%), so there's no evidence that the parameter has changed.

E4. 12% ± 5%, or (7%, 17%).

E5. It does! Since 5% is lower than the smallest percentage in the CI, we are 95% confident that the condition is more prevalent than it once was.

E6. The second one (**E4**) – all other things being equal, larger sample sizes yield smaller MOEs.

E7. Any statistic drawn from a population has **sampling error**…this is OK! It's totally fine, and completely unavoidable; when you draw a sample from a population (even if you draw it perfectly), your sample's center will, most likely, not agree exactly with the parameter you're trying to estimate. The MOE helps to alleviate this lack of perfect precision by casting a wider net around the statistic (remember the terrible bear joke?).

"What is Confidence?" Quizzes

Quiz 1.

In the article "***Tobacco Use Among Middle and High School Students — United States, 2011–2015***" (www.cdc.gov/mmwr/volumes/65/wr/mm6514a1.htm?s_cid=mm6514a1_w), the results of a study on teen and preteen smoking were discussed. One of these results was that, in 2015, 25.3% of high school students "reported current use of any tobacco product". Because of the very large sample (17,000), the MOE for this statistic was around 0.7%.

1. (**4 points**) Give the 95% CI of the incidence of high school smoking in America, based on this study's results.

2. (**3 points**) What does "95% confidence" mean?

3. (**3 points**) Why does this study (or ***any*** study, for that matter) require a MOE to be added to a sample statistic?

For years and years, folks have assigned "98.6 degrees Fahrenheit" as the the temperature that the "normal" human body temperature. Of course, that's a little silly – no one's ever *exactly* 98.6 degrees. Some Googling around tells me that a "normal" human body should be between 97.8 and 99 degrees Fahrenheit (source: https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=85&ContentID=P00866).

There are many conditions that result in significantly lowered body temperature (for example, diabetes, insomnia or sepsis). Suppose a researcher is interested to see if hypothyroidism might significantly lower core body temperature, as well. She draws a random sample of hypothyroidic patients and finds their average body temperature to be 97.0 degrees Fahrenheit with a MOE of 1 degree Fahrenheit.

1. (**1 point**) Give the 95% CI for the average body temperature of hypothyroidic patients, based on these study results.

 Suppose someone asks you this:

"***Why even form a CI? I mean, the data shows that the hypothyroidic patients have an average temperature of 97 degrees Fahrenheit…that's lower than the lowest 'normal' temperature of 97.8 degrees Fahrenheit.***"

2. (**3 points**) Respond to that question in at least two sentences. Be sure to use the terms *statistic*, *parameter*, and *MOE*.

3. (**3 points**) Why is this CI **not** evidence that hypothyroidism significantly lowers body temperature?

4. (**3 points**) Give a MOE that **would** allow the researcher to believe that hypothyroidism might, indeed, be lowering body temperature (many answers are possible).