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Stat 145, Fri 19-Mar-2021 -- Fri 19-Mar-2021
Biostatistics
Spring 2021


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Friday, March 19th 2021
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Wk 7, Fr
Topic:: Central Limit Theorem
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Central Limit Theorem

In summary, here is the take-away from the **Central Limit Theorem**.

Suppose you have a random sample of size n that is either

- i.i.d., or (like sampling w/ replacement)
- an SRS, with the sample size n being no more than 10% of the size of the population.

In the case that

$n \geq 30$

1. the variable under consideration is quantitative, having population mean μ and standard deviation σ, then the sampling distribution for the sample mean $\overline{X}$ is approximately $\mathsf{Norm}(\mu, \sigma/\sqrt{n})$ for n large enough.

   center of sampling dist for $\overline{X}$: μ ; $SE_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

2. the variable under consideration is binary categorical, having population proportion p, then the sampling distribution for the sample proportion $\widehat{p}$ is approximately $\mathsf{Norm}(p, \sqrt{p(1-p)/n})$ for n large enough.

$SE_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$

Rules of thumb: n is large enough when

$$\boxed{\begin{array}{l} np \geq 10 \\ n(1-p) \geq 10 \end{array}}$$

Since

- null distributions
- randomization distributions
- bootstrap distributions

are all specialized versions of sampling distributions, then so long as the sample statistic in question is the sample's *mean* $\overline{X}$ or the sample *proportion* $\widehat{p}$, we can expect the CLT to apply to these as well.

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Explorations using apps at
  https://onlinestatbook.com/stat_sim/sampling_dist/index.html
  https://shiny.calvin.edu:3838/scofield/samplingDists/
  https://shiny.calvin.edu:3838/scofield/cltProportions/
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