Sampling and Sampling Distributions

Non-probability Sampling

Probability Sampling

**Sampling distribution:** distribution of possible values of a *sample statistic* assuming it is from a random sample

**Sample Proportion sampling distribution—**

\[ E(\hat{P}) = P \]
\[ Var(\hat{P}) = \frac{P(1-P)}{n} \]

**Sample Mean sampling distribution –**

\[ E(\overline{X}) = \mu \]
\[ Var(\overline{X}) = \frac{\sigma^2}{n} \]

**The sample proportion and mean sampling distributions are random variables**
**Standard Error:** standard deviation of the distribution of the sample mean or proportion

How far is a typical sample mean from the population mean?

For a sample mean:

$$SE = SD(\bar{X}) = \frac{\sigma}{\sqrt{n}}$$

For a sample proportion:

$$SE = SD(\hat{P}) = \sqrt{\frac{p(1-p)}{n}}$$

*SE will increase* as variation in population increases (as measured by standard deviation)

*SE will decrease* as sample size increases

**Central Limit Theorem:**

Sampling distribution of sample mean is **approximately normal** regardless of the original distribution for large samples

gets *more normal* as sample size increases!

The $\bar{X}$ distribution with a large sample size.
The 1999 household income in the US had a mean of $44,000 and a standard deviation of $62,000. If I were to pick a random sample of 100 U.S. households, how likely am I to get a sample mean of household income more than $1000 above the population mean?

1. Write down the target and draw picture.

2. Find the standard error:

3. Find the standard score for our sample mean target value:

4. Look up score in Z table.
In 1999, 12% of people in the U.S. lived in households with income under the poverty level. What’s the probability that the poverty rate in a sample of 1000 people will be within 1 percentage point of the “true” proportion?

To find the probability for a sample proportion:

1. Find target and draw picture.

2. Find SE (Need pop SD first):

3. Find Z scores: