# Sampling Distributions

## Sample Means: $\bar{x}$

$\mu_{\bar{x}} = \mu$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

Normality

1. $x \sim N$
2. $n \geq 30$ (CLT)

Only 1. OR 2. needs to happen to assume normality

On formula sheet

$\Rightarrow \bar{x} \sim N\left(\mu, \sigma/\sqrt{n}\right)$

$\hat{p} \sim N\left(p, \sqrt{p(1-p)/n}\right) \Leftarrow$

## Sample Proportions: $\hat{p}$

$\mu_{\hat{p}} = p$

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

Normality

1. $np \geq 10$, 2. $n(1-p) \geq 10$

3. Ten percent rule

Both 1 AND 2 must happen to assume normality

## Sampling distribution = what shape is the graph of your data?

| | |
|---|---|
| $x \sim N(\mu, \sigma)$ | $x \sim B(n, p)$ |
| $\bar{x} \sim N\left(\mu, \sigma/\sqrt{n}\right)$ | $x \sim G(p)$ |
| $\hat{p} \sim N\left(p, \sqrt{p(1-p)/n}\right)$ | $x \sim U$ |

## Vocab/Extras

**parameter** $p, \mu, \sigma$

come from a population

**statistics** $\hat{p}, \bar{x}, s$

come from a samples

Statistics estimate parameters

# Sampling Distributions

On formula sheet ⟷

## Differences of Sample Means:

$$\mu_{\bar{x}\pm\bar{y}} = \mu_x \pm \mu_y$$

$$\sigma_{\bar{x}\pm\bar{y}} = \sqrt{\frac{\sigma_x^2}{n_x} + \frac{\sigma_y^2}{n_y}}$$

Normality

1. $x \sim N \quad y \sim N$
2. $n_x \geq 30$ and $n_y \geq 30$ (CLT)

Only 1. OR 2. needs to happen to assume normality

## Differences of Sample Proportions:

$$\mu_{\hat{p}_1-\hat{p}_2} = p_1 - p_2$$

$$\sigma_{\hat{p}_1-\hat{p}_2} = \sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$$

Normality

$n_1 p_1 \geq 10 \quad n_2 p_2 \geq 10$

$n_1(1-p_1) \geq 10 \quad n_2(1-p_2) \geq 10$

3. Ten percent rule for both populations

Both 1 AND 2 must happen to assume normality

## Sampling distribution = what shape is the graph of your data?

| | |
|---|---|
| $x \sim N(\mu,\sigma)$ | $x \sim B(n,p)$ |
| $\bar{x} \sim N\left(\mu, \sigma/\sqrt{n}\right)$ | $x \sim G(p)$ |
| $\hat{p} \sim N\left(p, \sqrt{p(1-p)/n}\right)$ | $x \sim U$ |

## Vocab/Extras

**parameter** $p,\ \mu,\ \sigma$

come from a population

**statistics** $\hat{p},\ \bar{x},\ s$

come from a samples

Statistics estimate parameters