Lesson 14 - Two Groups - Two Proportions

Lesson Objectives: 1. Simulation Based Two proportions

Parameter - association with direction

The difference in true proportions

$$\pi_1 - \pi_2$$

Statistic - Difference in observed proportions

$$\hat{P}_1 - \hat{P}_2$$

$H_0: \pi_1 - \pi_2 = 0$ *Difference*

$$H_a: \pi_1 - \pi_2 \begin{array}{c} > 0 \\ \neq 0 \\ < 0 \end{array}$$

Simulation Based

$$Z = \frac{observed - null}{SD} = \frac{(\hat{P}_1 - \hat{P}_2) - (\pi_1 - \pi_2)}{SD}$$

*where SD of null dist comes from simulation

$CI = observed \pm Multiplier * SD \rightarrow \hat{P}_1 - \hat{P}_2 \pm M * SD$

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We are comparing conditional proportions. $\rightarrow$

	Group A	Group B
	$\frac{count\ success}{count\ total}$	

Relative Risk $\rightarrow$ ratio of conditional proportions
Tells you how many times more likely an outcome is in one group compared to the other.

Overall Idea - assess whether two sample proportions differ enough to conclude that something other than random chance is responsible for the observed difference in groups.

$H_0: \pi_1 - \pi_2 = 0$ · literal translation: The proportion of success in Group 1 (π_1) minus the proportion of success in group 2 (π_2) is 0

There is no association between variables

$H_a: \pi_1 - \pi_2 \neq 0$ * There is an association*

Dolphin Therapy - Card Simulation

$H_0: \pi_{dolphin} - \pi_{control} = 0$ There is no association between swimming w/ dolphins and improvement in depression

$H_a: \pi_{dolphin} - \pi_{control} > 0$ There is an association. Swimming w/ dolphins increases probability of improving depression symptoms.

Results of The experiment

	Dolphin	Control	
Improve	10	3	13
No Improve	5	12	17
Total	15	15	30

$\hat{P}_{dolphin} = \frac{10}{15}$ $\hat{P}_{control} = \frac{3}{15}$ difference in conditional proportions

$\hat{P}_{dolph} - \hat{P}_{control}$ $\frac{10}{15} - \frac{3}{15} = \frac{7}{15} = .4667$ difference of 46.67 percentage points

This seems like alot but perhaps the 13 participants were going to show improvement regardless of group and we just happened by random chance, assigned more improvers to the dolphin group

Simulation: ① 13x Red → improvement   · Assume these outcomes
             17x Blue → no improvement   were going to happen no matter which group

② shuffle and simulate random assignment of subjects by putting in 2x groups (15 each)   → Pile on Left = dolph
                                                                                            R = control

③ Calculate difference in conditional proportions $\hat{P}_d - \hat{P}_c = \underline{\quad}$
                                                    # red cards in each group

④ Build distribution (centered on 0)

⑤ See if our statistic is likely to happen by random chance alone

$\frac{-5}{15} \quad \frac{-3}{15} \quad \frac{-1}{15} \quad 0 \quad \frac{1}{15} \quad \frac{3}{15} \quad \frac{5}{15}$