2015 AP Exam #4

STATE:

$H_0: p_1 - p_2 = 0$

$H_a: p_1 - p_2 < 0$

$n_1 = 500 \quad n_2 = 500$

$p_1 \rightarrow$ true proportion who develop colon cancer if they take aspirin.

$p_2 \rightarrow$ true proportion who develop colon cancer if they take placebo.

$\hat{p}_1 = \frac{15}{500} = 0.030 \quad \hat{p}_2 = \frac{26}{500} = 0.052 \quad \hat{p}_c = \frac{15+26}{500+500} = 0.041 \quad \alpha = .05$

PLAN:

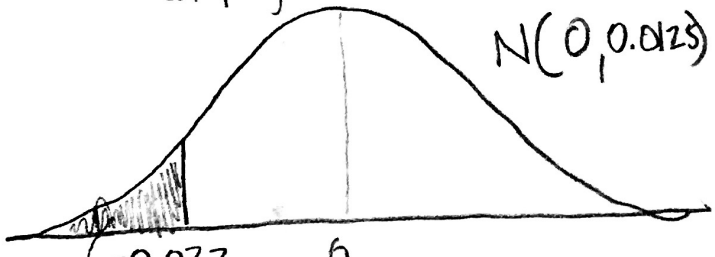
2 proportion z-test

Random: Not a random sample (volunteers) → can't generalize to population
Volunteers were randomly assigned → can show causation

Normal: The sampling distribution of $\hat{p}_1 - \hat{p}_2$ is approximately normal because: $n_1\hat{p}_1 = 15, n_1(1-\hat{p}_1) = 485$ $n_2\hat{p}_2 = 26, n_2(1-\hat{p}_2) = 474$ ≥ 10

Independent: The group who took aspirin is independent of the group who took the placebo (because of random assignment)

DO:



AREA = 0.0401

$$\text{TEST STATISTIC} = \frac{\text{STATISTIC} - \text{PARAMETER}}{\text{STD DEV OF STATISTIC}}$$

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

$$z = \frac{(0.030 - 0.052) - (0)}{\sqrt{\frac{(0.041)(0.959)}{500} + \frac{(0.041)(0.959)}{500}}}$$

$z = -1.75$

CONCLUDE

Assuming H_0 is true ($p_1 - p_2 = 0$), there is a 0.0401 probability of getting a $\hat{p}_1 - \hat{p}_2$ value of -0.022 or lower purely by chance. This provides good evidence against H_0 and is statistically significant ($.0401 < .05$) Therefore, we reject H_0 and can conclude that the proportion who develop colon cancer if they take aspirin is lower than the proportion who develop caner if they take placebo (for volunteers).