2-PROPORTION Z-TEST

This test is used to compare proportions from 2 independent samples.

In s study done in Michigan, it was determined 38 (out of 62) poor children who attended pre-school needed social services later in life compared to 49 (out of 61) poor children who did not attend preschool.

Does this study provide significant evidence that preschool reduces the need for social services later in life?

P)   IDENTIFY POPULATION PARAMETERS:

p_1 = proportion of preschooled children requiring social services ($\hat{p}_1 = \dfrac{38}{62} = .6129$)

p_2 = proportion of non- preschooled children requiring social services ($\hat{p}_2 = \dfrac{49}{61} = .8033$)

H)   STATE HYPOTHESES:

$H_0 : p_1 = p_2$ $\qquad\qquad$ $H_a : p_1 < p_2$

A)   VERIFY CONDITIONS REQUIRED FOR TEST:

a)   Random

   It is <u>not</u> known if these were random samples so our conclusions may not be applicable to this study

b)   Normal Sampling Distributions

   $n_1 \hat{p}_1 = (62)(.6129) = 37.9 > 10$ ✓ $\qquad$ $n_2 \hat{p}_2 = (61)(.8033) = 49 > 10$ ✓
   $n_1 (1 - \hat{p}_1) = (62)(.3871) = 24 > 10$ ✓ $\qquad$ $n_2 (1 - \hat{p}_2) = (61)(.1967) = 11.9 > 10$ ✓

c)   Independent

   $N_1 > 10(62) > 620$ preschooled children in Michigan ✓

   $N_2 > 10(61) > 610$ non preschooled children in Michigan ✓

T) **PERFORM TEST USING**

a) **TABLE A:**

Calculate z-statistic and check Table:

$$\hat{p} = \frac{total \ number \ of \ successes \ in \ both \ samples}{total \ number \ of \ observations \ in \ both \ samples} = \frac{87}{123} = .7073$$

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})(\frac{1}{n_1} + \frac{1}{n_2})}} = \frac{.6129 - .8033}{\sqrt{(.7073)(.2927)(\frac{1}{62} + \frac{1}{61})}} = -2.32$$

P-value = .0102

b) **CALCULATOR:**

STAT $\longrightarrow$ TESTS $\longrightarrow$ 2-Prop Z Test $\longrightarrow$ P-value = .0102

DISTR $\longrightarrow$ normalcdf (–100, –2.32) = .01017

S) **STATE CONCLUSION:**

There is strong (but not overwhelming evidence) that preschool reduces the future need for social services. We can reject H_0 at $\alpha = .05$ but not at $\alpha = .01$.

CONFIDENCE INTERVAL:

Construct a 95% confidence interval for the difference in proportions of people needing social services after attending preschool:

P) See above

A) See above

I) **Construct Interval**

   a) **Using Formula**

$$CI = (\hat{p}_1 - \hat{p}_2) \pm z* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

$$CI = (.6129 - .8033) \pm 1.960 \sqrt{\frac{(.6129)(.3871)}{62} + \frac{(.8033)(.1967)}{61}}$$

$$CI = (-.35, -.03)$$

   b) **Using Calculator**

   STAT $\longrightarrow$ TESTS $\longrightarrow$ 2-Prop Z Int = $(-.35, -.03)$

S) **State Conclusion** (Use *less* or *more*)

   We are 95% confident that the percentage of people needing social services after attending preschool was between 3% and 35% less than those who did not attend preschool.

   Note: The interval is quite wide because the sample sizes were small.