

Homework 13.2 **10 points show ALL steps for full credit**

Treating AIDS

The drug AZT was the first drug that seemed effective in delaying the onset of AIDS. Evidence for AZT's effectiveness came from a long randomized comparative experiment. The subjects were 1300 volunteers who were infected with HIV, the virus that causes AIDS, but did not yet have AIDS. The study assigned 435 of the subjects at random to take 500 milligrams of AZT each day and another 435 to take a placebo. (The others were assigned to a third treatment; however, we will only compare only two groups). At the end of the study, 38 of the placebo subjects and 17 of the AZT subjects had developed AIDS. Test the claim that taking AZT lowers the proportion of infected people who will develop AIDS in a given time period.

p_p : True proportion of all HIV positive individuals who develop will AIDS if treated with only a placebo

p_{AZT} : True proportion of all HIV positive individuals who develop will AIDS if treated with 500mg of AZT per day

$$H_0: p_p = p_{AZT}$$

$$H_A: p_p > p_{AZT}$$

Perform a two-sample z-test for proportions

1) Assume that the subjects were an SRS of the population

$$\begin{array}{cccc} 2) n_p(\hat{p}_p) \geq 5 & n_p(1 - \hat{p}_p) \geq 5 & n_{AZT}(\hat{p}_{AZT}) \geq 5 & n_{AZT}(1 - \hat{p}_{AZT}) \geq 5 \\ 435(.087) \geq 5 & 435(.913) \geq 5 & 435 (.039) \geq 5 & 435 (.96) \geq 5 \\ 38 \geq 5 & 397 \geq 5 & 17 \geq 5 & 418 \geq 5 \end{array}$$

Condition for Normality has been met ☺

3) The samples are independent

4) It is stated that the subjects were randomly assigned to the treatment groups

$$\hat{p}_p = 0.0874$$

$$\hat{p}_{AZT} = 0.039$$

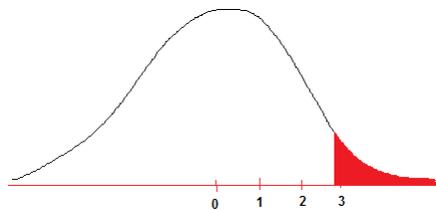
$$z = 2.926$$

$$p\text{-value} = 0.002$$

$$n_p = 435$$

$$n_{AZT} = 435$$

$$\hat{p}_C = 0.063$$



Because our p-value of 0.002 is so low, we can reject H_0 . There is evidence that the true proportion of all HIV positive individuals who develop will AIDS if treated with only a placebo is greater than the true proportion of all HIV positive individuals who develop will AIDS if treated with 500mg of AZT per day. We have evidence that the treatment lower the proportion of infected people who will develop AIDS in a given time period.

ARE URBAN STUDENTS MORE SUCCESSFUL?

North Carolina State University looked at the factors that affect the success of students in a required chemical engineering course. Students must get a C or better in the course in order to continue as chemical engineering majors. 65 students from urban or suburban backgrounds were randomly selected, and 52 of these students succeeded. 55 students from rural or small-town backgrounds were randomly selected; 30 of these students succeeded in the course.

- (a) Give a 90% confidence interval for the true difference in success rates for urban/suburban students versus rural students in the required chemical engineering course.

P_U : True proportion of all students from urban/suburban backgrounds who will succeed in the chemical engineering course

P_R : True proportion of all students from rural backgrounds who will succeed in the chemical engineering course

Perform a two-sample z-interval for proportions

- 1) Each sample was an SRS (random selection stated in problem)
- 2) $n_U(\hat{p}_U) \geq 5$ $n_U(1 - \hat{p}_U) \geq 5$ $n_R(\hat{p}_R) \geq 5$ $n_R(1 - \hat{p}_R) \geq 5$
 $65(.8) \geq 5$ $65(.2) \geq 5$ $55(.545) \geq 5$ $55(.455) \geq 5$
 $52 \geq 5$ $13 \geq 5$ $30 \geq 5$ $25 \geq 5$

Condition for Normality has been met ☺

- 3) The samples are independent
- 4) Assume that there are at least $10(65) = 650$ students in the population with urban backgrounds and $10(55) = 550$ students in the population with rural backgrounds.

$$\begin{array}{lll} \hat{p}_U = 0.8 & \hat{p}_R = 0.545 & CI = (0.11723, 0.39186) \\ n_U = 65 & n_R = 55 & \end{array}$$

We are 90% confident that the true difference in the proportion of successful urban/suburban students vs. the proportion of successful rural student in the required chemical engineering course is between 0.11723 and 0.39186.

- (b) Based only on this confidence interval, do you think the difference in success rates is statistically significant?

$H_0: p_U = p_R$ Because 0 was not included in the confidence interval, we have
 $H_A: p_U \neq p_R$ evidence that the difference in success rates is statistically significant.

 You didn't **have** to define hypotheses. That part is optional.

ARE GIRLS OR BOYS MORE SUCCESSFUL ?

The North Carolina State University Study (from the previous problem) also looked at possible difference in the proportions of female and male students who succeeded in the course. They randomly selected 34 women who had taken the course. 23 out of the 34 women succeeded. They randomly selected 89 men who had taken the course. 60 of the 89 men succeeded. Is there evidence of a difference between the proportions of women and men who succeed?

P_F : True proportion of all female students who will succeed in the chemical engineering course

P_M : True proportion of all male students who will succeed in the chemical engineering course

$$H_0: p_F = p_M$$

$$H_A: p_F \neq p_M$$

Perform a two-sample z-test for proportions

1) Each sample was an SRS (random selection stated in problem)

$$\begin{array}{llll} 2) n_F(\hat{p}_F) \geq 5 & n_F(1 - \hat{p}_F) \geq 5 & n_M(\hat{p}_M) \geq 5 & n_M(1 - \hat{p}_M) \geq 5 \\ 34(.677) \geq 5 & 34(.324) \geq 5 & 89 (.674) \geq 5 & 89 (.326) \geq 5 \\ 23 \geq 5 & 11 \geq 5 & 60 \geq 5 & 19 \geq 5 \end{array}$$

Condition for Normality has been met 😊

3) The samples are independent

4) Assume that there are at least $10(34) = 340$ female students in the population and $10(89) = 890$ male students in the population.

$$\hat{p}_F = 0.6765$$

$$\hat{p}_M = 0.6742$$

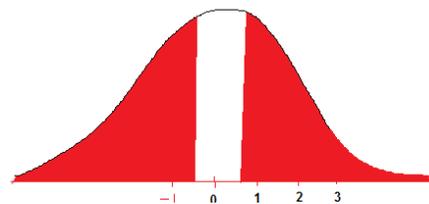
$$z = 0.245$$

$$p\text{-value} = 0.98$$

$$n_F = 34$$

$$n_M = 89$$

$$\hat{p}_C = 0.675$$



Because our p-value of 0.98 is SO large, we can fail to reject H_0 . There is NOT evidence that the true proportion of all female students who will succeed in the chemical engineering course is different than the true proportion of all male students who will succeed in the chemical engineering course.