

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

You can use your calculator for the calculations =)

#### 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.

#### STATE:

$p_A$  = the true proportion of patients taking AZT who will develop AIDS in a given time period

$p_p$  = the true proportion of patients taking a placebo who will develop AIDS in a given time period

$$H_0 : p_A = p_p$$

$$H_A : p_A < p_p$$

#### PLAN:

Two sample z-test for proportions

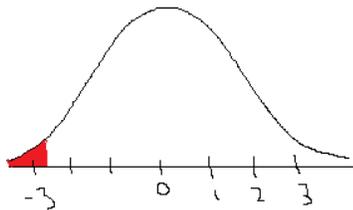
- 1) The subjects were **randomly assigned** to treatments
- 2) *You don't need typically to check the 10% condition for experiments; however, if you do, you would use the entire sample size.* "Assume that there are at least  $10(1300) = 13,000$  individuals with HIV in the population.

3) $n\hat{p}_A \geq 10$	$n(1 - \hat{p}_A) \geq 10$	$n\hat{p}_A \geq 10$	$n(1 - \hat{p}_A) \geq 10$
$435 (17/435) \geq 10$	$435 (418/435) \geq 10$	$435 (38/435) \geq 10$	$435 (397/435) \geq 10$
$17 \geq 10$	$418 \geq 10$	$38 \geq 10$	$397 \geq 10$

All conditions have been met

#### DO:

$$z = -2.93$$
$$P\text{-value} = 0.0017$$
$$\hat{p}_A = 0.04$$
$$\hat{p}_p = 0.09$$
$$\hat{p}_c = 0.63$$
$$n_A = 435$$
$$n_p = 435$$



Commented [SK1]: We can go over this in class tomorrow ☺

#### CONCLUDE:

Because our p-value (0.0017) is lower than any reasonable significance level, we can reject  $H_0$ . We have evidence that taking AZT lowers 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.

$p_U$  = the true proportion of students from urban/suburban backgrounds who succeed in the NCSU chem engineering course.

$p_R$  = the true proportion of students from rural/small-town backgrounds who succeed in the NCSU chem engineering course.

We want to estimate  $p_U - p_R$  with 90% confidence

#### PLAN:

Two sample z-interval for proportions

- 1) The researchers used two independent, random samples
- 2) Assume that there are at least  $10(65) = 650$  urban/suburban students at NCSU and  $10(55) = 550$  rural/small-town students at NCSU.
- 3) 

$n\hat{p}_U \geq 10$	$n(1 - \hat{p}_U) \geq 10$	$n\hat{p}_R \geq 10$	$n(1 - \hat{p}_R) \geq 10$
$65 (52/65) \geq 10$	$65 (13/65) \geq 10$	$55 (30/55) \geq 10$	$55 (25/55) \geq 10$
$52 \geq 10$	$13 \geq 10$	$30 \geq 10$	$25 \geq 10$

All conditions have been met

#### DO:

(0.11723, 0.39186)

$\hat{p}_U = 0.8$

$\hat{p}_R = 0.545$

$n_U = 65$

$n_R = 55$

#### CONCLUDE:

We are 90% confident that the difference in success rates in the NCSU chemical engineering course for urban/suburban students and rural/small-town students ( $p_U - p_R$ ) is between 0.11 and 0.39. In other words, we are 90% confidence that urban/suburban students who take this course have a success rate that is between 11% and 39% higher than rural/small-town students who take the course.

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

YES. The difference in success rates for these students is significant at the 10% level because 0 is not included in the interval.

### 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?

$p_m$  = the true proportion of male students who succeed in the NCSU chem engineering course.  
 $p_F$  = the true proportion of female students who succeed in the NCSU chem engineering course.

$H_0 : p_m = p_F$   
 $H_A : p_m \neq p_F$

**PLAN:**

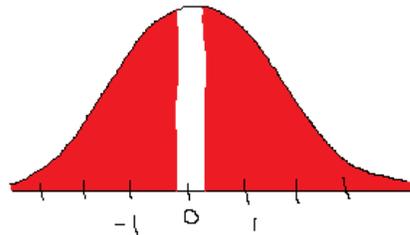
Two sample z-test for proportions

- 4) The researchers used two independent, random samples
- 5) Assume that there are at least 10(89) = 890 male students at NCSU and 10(34) = 340 female students at NCSU.
- 6)  $np_m \geq 10$                        $n(1 - \hat{p}_m) \geq 10$                        $n\hat{p}_F \geq 10$                        $n(1 - \hat{p}_F) \geq 10$   
 $89(60/89) \geq 10$                        $89(29/89) \geq 10$                        $34(23/34) \geq 10$                        $34(11/34) \geq 10$   
 $60 \geq 10$                                    $29 \geq 10$                                    $23 \geq 10$                                    $11 \geq 10$

All conditions have been met

**DO:**

$z = -0.0244$   
P-value = 0.9805  
 $\hat{p}_M = 0.674$   
 $\hat{p}_F = 0.676$   
 $\hat{p}_c = 0.674$   
 $n_M = 89$   
 $n_F = 34$



**CONCLUDE:**

Because our p-value (0.9805) is much larger than any reasonable significance level, we fail to reject  $H_0$ . We do not have evidence of a difference between the proportions of women and men who succeed in the NCSU chemical engineering course.