Math 146 9.1 - Tests for Two Proportions

EXAMPLE 1 **Bednets to Reduce Malaria** In a randomized controlled trial in Kenya, insecticide- treated bednets were tested as a way to reduce malaria. Among 343 infants using bednets, 15 developed malaria. Among 294 infants not using bednets, 27 developed malaria (based on data from "Sustainability of Reductions in Malaria Transmission and Infant Mortality in Western Kenya with Use of Insecticide-Treated Bednets," by Lindblade et al., Journal of the American Medical Association, Vol. 291, No. 21). We want to use a 0.01 significance level to test the claim that the incidence of malaria is lower for infants using bednets.

NOTATION

Population 1

p_1 = *population* proportion

n_1 = sample size

x_1 = # of success

$\hat{p}_1$ = *sample* proportion

Population 2

p_2 = *population* proportion

n_2 = sample size

x_2 = # of success

$\hat{p}_2$ = *sample* proportion

The **pooled sample proportion:** $\overline{p} = \frac{x_1+x_2}{n_1+n_2}$

REQUIREMENTS

1. Samples are from two *independent* simple random samples.
2. For each sample, there are at least 5 success and five failures for each sample ($n_1 p_1 \geq 5$, $n_1 q_1 \geq 5$, $n_2 p_2 \geq 5$, and $n_2 q_2 \geq 5$)

TEST STATISTIC AND THE NULL HYPOTHESIS

The null hypothesis is always assumed to be $H_0 : p_1 = p_2$ which can also be written as $H_0 : p_1 - p_2 = 0$

The sample test statistic is: $z = \frac{(\hat{p}_1-\hat{p}_2)-(p_1-p_2)}{\sqrt{\frac{\overline{p}\,\overline{q}}{n_1}+\frac{\overline{p}\,\overline{q}}{n_2}}}$, but we will use the TI to calculate the test statistics.

Create a hypothesis test for the example given above, and use **2-PropZTest** *on the TI84, or Hypothesis Test for Two Proportions with EasyCalc to calculate the test statistics.*

CONFIDENCE INTERVAL FOR ESTIMATING $p_1 - p_2$

$(\hat{p}_1 - \hat{p}_2) - E < (p_1 - p_2) < (\hat{p}_1 - \hat{p}_2) + E$ where the margin of error is $E = z_{\alpha/2}\sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$

Create an appropriate confidence interval for $p_1 - p_2$ for the above problem.

EXAMPLE 2 **Police Gunfire** In a study of police gunfire reports during a recent year, it was found that among 540 shots fired by New York City police, 182 hit their targets; and among 283 shots fired by Los Angeles police, 77 hit their targets (based on data from the New York Times). We want to use a 0.05 significance level to test the claim that New York City police and Los Angeles police have the same proportion of hits.

a. Test the claim using a hypothesis test.

b. Test the claim by constructing an appropriate confidence interval. (Warning: this does not always agree with the conclusion using the P-value method.)