

Assessing the Difference between Two Proportions

(Inspired by #5 from 2013 AP Exam)

Psychologists interested in the relationship between meditation and health conducted a study with a random sample of 26 men who live in a large retirement community. Of the men in the sample, 11 reported that they participate in daily meditation and 15 reported that they do not participate in daily meditation. The researchers wanted to perform a hypothesis test to determine if meditation has an effect on lowering blood pressure among men like these.

1. If p_m is the proportion of men with high blood pressure among all the men in the retirement community who participate in daily meditation and p_c is the proportion of men with high blood pressure among all the men in the retirement community who do not participate in daily meditation, state an appropriate pair of hypotheses:

H_0 : _____

H_a : _____

2. Critique the design of the study: *If the study were to provide significant evidence against H_0 in favor of H_a , would it be reasonable for the psychologists to conclude that daily meditation causes a reduction in blood pressure for men in the retirement community? Explain why or why not.*

The psychologists found that of the 11 men in the study who participate in daily meditation, 0 had high blood pressure. Of the 15 men who do not participate in daily meditation, 8 had high blood pressure.

3. Checking the conditions for inference: we know that the men were *not* assigned randomly to their groups. Are the other conditions for inference on two proportions met here?

CREATING A MODEL

We cannot use the normal model as a model for $\hat{p}_m - \hat{p}_c$ here. So we must rethink the model. Consider the null hypothesis. It states that the true proportions of men with high blood pressure are the same within the population. **Another way of saying this** is that the discrepancy we obtained in our sample was simply due to chance – those 8 men with high blood pressure would have had high blood pressure regardless of whether they meditated or not.

You are being assigned 26 cards. Eight of them () correspond to the men with high blood pressure. The rest () correspond to the men without high blood pressure.

In some random fashion, assign 11 cards to be the “meditation” group, and the remaining 15 cards to be the “control” group.

Calculate $\hat{p}_m - \hat{p}_c$ and plot its value on the dotplot provided.

$\hat{p}_m =$ _____ $\hat{p}_c =$ _____ $\hat{p}_m - \hat{p}_c =$ _____

$\leftarrow \hat{p}_m - \hat{p}_c \rightarrow$

Repeat this process a few more times and combine your results with those of the rest of the class. This will create an approximate sampling distribution for $\hat{p}_m - \hat{p}_c$.

Go to <http://www.lock5stat.com/StatKey/index.html> and select “Test for a Difference in Proportions.” Select “Edit Data” and enter our data – 0 out of 11 and 8 out of 15. Generate 10,000 simulations of the activity we just did.

4. Sketch a histogram of the simulated sampling distribution below.

$\leftarrow \hat{p}_m - \hat{p}_c \rightarrow$

INFERENCE ON THE MODEL

5. Based on the results of the simulation, what can be concluded about the relationship between blood pressure and meditation among men in the retirement community?