Research Minute

Statistics 201— Two-Variable Statistics. Chi-Square

Issue 16

Sandra Burge, Ph.D.

The purpose of research is to understand the relationships between two Phenomena, like...

- Does SBIRT (Phenomenon 1) reduce patients' alcohol consumption (Phenomenon 2) ?
- Do group visits with families (Phenom 1) reduce obese children's BMI (Phenom 2) ?
- Does a clinic education program (Phenom 1) improve immunization rates (Phenom 2)?
- Are there ethnic differences (Phenom 1) in the prevalence of breast cancer (Phenom 2)?

One common research question is:

Are there group differences (Phenom 1) in the prevalence of condition A (Phenom 2)?

In this question, the appropriate statistical test is the **Chi-Square (X^2) analysis.**

Comparing Group Prevalence with Chi-Square (X^2)

The Chi-Square test (X^2) compares groups' actual prevalence with what we might expect by chance.

Let's start with a research question: *Are there gender differences in prevalence of depression?*

In this question the predictor variable (Phenom 1) is "gender" (male or female) while the outcome variable (Phenom 2) is "depression diagnosis" (present or absent).

A sample of 147 subjects is shown in the Table below. The ***actual*** prevalence of depression is 31% of the men and 50% of the women.

We have to compare this to the prevalence we might ***expect by chance***. What would that be? Simply stated, we expect the 2 groups to be *the same*—that is, we would expect both gender groups to have a prevalence of 43% (total sample prevalence). This would be 20.64 men and 42.57 women.

To calculate X^2, we use the following mathe-magic:

$$X^2 = \sum \frac{(O-E)^2}{E}$$

In each cell, subtract the expected value from the actual value and square the difference. Divide this by the expected value. Now add up these results from each cell. That is X^2.

Below, $X^2 = 4.377$ with $p=.036$. The differences are statistically significant (because p is less than .05).

To make your life easier, use this free chi-square calculator. Plug in your actual numbers. (Do not use %.)

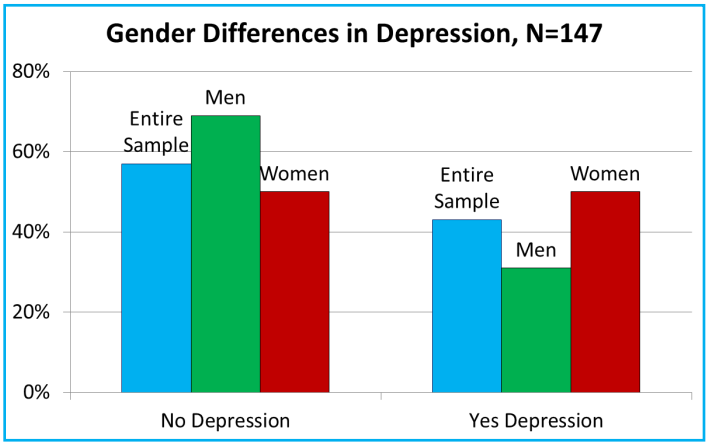
http://home.ubalt.edu/ntsbarsh/Business-stat/otherapplets/Catego.htm

Good news—X^2 can assess larger tables; it is not limited to 2 x 2 tables.

Not as good news—X^2 requires expected values to be 5 or greater in each cell.

Research Question: Are there gender differences in the prevalence of depression?

	No-Depression	Yes - Depression
Male	33 (69% men)	15 (31% men)
Female	50 (50% women)	49 (50% women)
TOTAL	83 (57% sample)	64 (43% sample)



burge.researchminutes@gmail.com

Art by Brian Hischier