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.

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### 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 \( p = 0.036 \). 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](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.

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| 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) |

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### Gender Differences in Depression, N=147

[Graph showing gender differences in depression prevalence]