# **Chi-Square Statistic**

## Info Sheet

* Used to compare observed/recorded/measured data with data that you would expect (Expectation is an expected numerical value)
* X2 tests **goodness of fit** between observed and expected data. Are the observed numbers close to what you expected given your hypothesis?
* Determine level of significance using Probability (p-value)

Trying to determine probability [*level of significance*] that there will be deviations from expected results. Observations may be **statistically significant** or **highly statistically significant**. If this occurs, then hypothesis used to determine the expected numbers is probably incorrect.

***If there are deviations (difference between observed and expected) are they due to chance alone? or are other factors influencing outcome ?***

**Accept hypothesis if** 

* X-square values will be **small**/less than critical p value.
* P value (probability) will be greater than (.05) [ p > .05 ]
* The greater the p value, the higher the probability that differences in data are the result of chance alone and not due to some unknown source.

***Ex****. If a x2 value of .10 is calculated, with 1 degree of freedom, the critical value at p = .05 is 3.84. Since .10 is far below this value, we would say that the observed x2 value is* ***not*** *significantly different from the expected chi-square value. We would say that our collected data* ***supports*** *our hypothesis.*

**Reject hypothesis if **

* X-square values will be **large**. The more degrees of freedom, the greater the number.
* P value will be less than (.05)[ p < .05 ]

***Ex.*** *If a p value of 0.01 is obtained given your X2 value, this means that there is only a 1% chance that the deviations are due to chance alone. Other factors must be involved in the differences****.***

Higher values of test statistic (X-square value) the smaller probability that hypothesis is true.

**If p value is about 0.05 or less**  [ p < 0.05 ]

* 5% probability (or less) that deviation in observed from expected is due to chance alone.
* If X2 value falls at p < 0.05, then probability is low that chance alone is influencing outcome. Some other variable is at work.

Quick note on critical value (p=probability): p, the critical value marks the worst condition of data.  For good data, difference between o & e will be very small.

p value of 0.05 assumes that the null hypothesis is true (o=e) within which 95% of the test statistic samples will fall  whereas p value of 0.01 assumes that the null hypothesis is true (o=e) within 99% of the samples. This makes sense then that the interval for 99% would be larger than that contains only 95% of the samples.

Now let's turn things around. The test also means that there is only a 5% chance that the test statistic will be greater than 3.841 if the null hypothesis is true, and only a 1% chance that it will be greater than 6.64 when degree of freedom of 1.

The test does not prove that the null hypothesis is true or false. It only indicates whether or not the data is consistent with it, at some level of significance.