

Choosing the Correct Statistical Test
Chi-Square Analysis

February 20, 2006

Choosing the Correct Statistical Test

- Knowing which statistical test to use in order to test the relationship between your independent and dependent variables depends on the 'type' of data that you have.

Scales of Measurement

- A Variable is anything we measure
- Remember NOIR

Continuous vs. Discreet Variables

- **Continuous Variables** – a variable that can represent any value on the scale used to measure the variable (typically interval or ratio variables)
 - Number of Cokes drink per week (1, 1.5, 2)
 - "how much" --- amount
- **Discreet Variables** – a variable that can represent only a few specified values on a designated scale (typically nominal, ordinal variables)
 - Male (1) or female (2)
 - "how many" --- type

Measurement vs. Categorical Variables

- **Measurement Variables** – things to which we can assign an 'actual' number. Something we can measure, quantitative.
 - Age, height, weight
- **Categorical Variables** – things to which we may assign a number to, but the number represents type rather than amount, thus qualitative.
 - Race, gender
 - Dichotomous categorical variables – only two possible outcomes (yes or no; male or female)

CHOOSING THE RIGHT STATISTICAL TEST

		Dependent Variable	
		Measurement Continuous (Quantitative)	Categorical Discreet Qualitative
Independent Variable	Measurement Continuous (Quantitative)	Regression Correlation	Logistic Regression Point-Biserial Correlation
	Categorical Discreet Qualitative	T-test ANOVA Regression Point-Biserial Correlation	Chi-Square Logistic Regression Phi & Cramer's V

So, what test do we use to test our primary hypothesis?

- Our independent variable is

- Our dependent variable is...

Chi Square Analysis

- Chi square Analysis (χ^2) provides probabilities based on frequencies.
- Thus, data consists of frequency counts of your variable categories.
- Chi square analysis compares the observed frequency counts to the frequency counts that would be expected if the null hypothesis was true (thus, chance)
- This is the statistical analysis to statistically tests for statistical significance.

Chi Square Analysis

- **To calculate χ^2 , us this formula**
$$\chi^2 = \sum [(O - E)^2 / E]$$
 - where O = observed frequency, or the number of events in each category
 - where E = expected frequency, use '**test of independence**' or 'goodness of fit' calculations
- Degrees of freedom in a chi square analysis
 - $df = (R-1)(C-1)$

Chi Square Analysis – Finding the Expected Score

1. Test of Independence

- Tests the null hypothesis that the two variables are independent, or that there is NO relationship to one another.
- The most common test used for chi square analyses

Chi square analyses

Hypothetical data on attitudes toward war

- 140 participants
- Male or Female – variable is...
- Acceptable or Unacceptable – variable is...

*Keep in mind in chi square, participants can only be in ONE of the dependent categories

	War		Σ
	Acceptable	Unacceptable	
Men	59	29	88
Women	15	37	52
Σ	74	66	140

Chi-Square – Expected Frequencies

	War		Σ
	Acceptable	Unacceptable	
Men	59 (46.51)	29 (41.49)	88
Women	15 (27.49)	37 (24.51)	52
Σ	74	66	140

HOW DO WE GET THESE EXPECTED FREQUENCIES...FOLLOW THE MATH...

How do we get to the χ^2 Statistic?

$$\chi^2 = \sum [(O - E)^2 / E]$$

O	E	O-E	(O-E) ²	(O-E) ² /E
59	46.51			
15	27.49			
29	41.49			
37	24.51			
				$\chi^2 =$

Chi Square Analysis

- Don't forget degrees of freedom
 - $df = (R-1)(C-1)$
- Critical Values for Chi Square analysis
 - Critical values table on page 360 (Table C.2) in your Cozby textbook
 - In general, $\chi^2_{.05} (1df) = 3.84$, then you may reject your null hypothesis.

Chi Square Analysis

- What can we conclude?

Chi square analysis

- Effect Size
 - How MUCH difference is there?
 - We may know that the differences are statistically significant...but HOW different are the two groups...this is effect size (the **degree** of the relationship)
 - For chi square, we look at **Phi coefficient** or Cramer's V (if extends beyond a 2 x 2)

Chi Square Analysis - Effect Size

- **Phi coefficient** (Φ) – used in 2 x 2 tables
 - $\Phi = \sqrt{\chi^2/N}$
 - Thus, our Phi coefficient in our example would be...
- What is a good effect size?
 - .10 – small effect
 - .30 – medium effect
 - .50 – large effect

Limitations of Chi square

- Responses must be independent and mutually exclusive and exhaustive
 - Each case from a sample MUST fit into one and only one cell in our matrix
