Chapter 26 – Comparing Counts

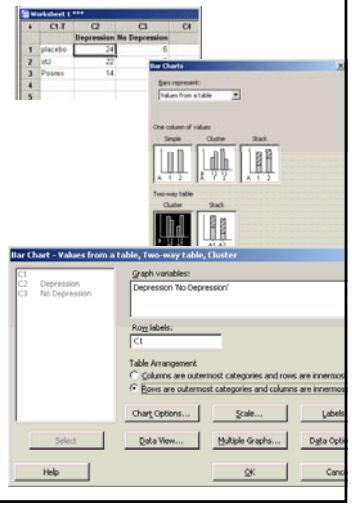
Depression

- Medical researchers enlisted 90 subjects for an experiment comparing treatments for depression.
- The subjects were randomly divided into three groups and given pills to take for a period of three months.
- Unknown to them, one group received a placebo, the second group the 'natural' remedy St. John's wort, and the third group the prescription drug Posrex.
- After 6 months, psychologists and physicians (who did not know which treatment each person had received) evaluated the subjects to see if their depression had returned.

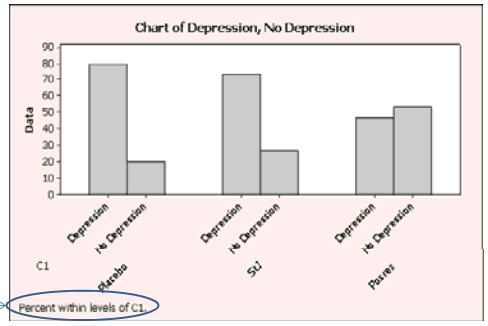
	Placebo	StJ	Posrex
Depression Returned	24	22	14
No Sign of Depression	6	8	16

Graph the Data

- Enter the data in Minitab as it is written in the given table (complete with row and column names)
- Graph > Bar Chart
  - Bars Represent: Values from a table
  - Under Two-way Table: Cluster
  - Graph Variables: select columns with the numbers from your table
  - Row labels: Enter location
  - Table Arrangement: Your Choice
    - I went with drug as outermost category because I am curious to see a relationship between depression/not for the different drugs



Just Checking…



Note: Use %

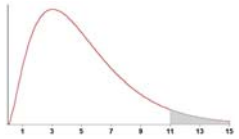
- Is the distribution the same across all drugs?

Tests of Homogeneity

- A **test of homogeneity**, is an extension of the 2 proportion z-test.
  - We will test the null hypothesis that groups are drawn from populations in which the variable has the same model
    - Ex: The distribution of depression/not is the same across all drugs
- To conduct this test, we calculate the **chi-square statistic**, or **χ^2 statistic**
  - The χ^2 statistic is a measure of how far the observed values are from what would be expected under the null hypothesis of independence
  - χ^2 – "Chi Square" - Rhymes with High

Assumptions and the χ^2 Model

- Assumptions/Conditions
  - Counted Data Condition
  - Randomization Condition (Representativeness)
  - Expected Cell Frequency Condition: The expected count in each cell must be at least 5 (confirmed as we conduct the test)
- Under the assumptions/conditions, the χ^2 statistic follows a χ^2 Distribution (Model)
- Features of the χ^2 Distribution
  - Starts at (0,0)
  - Skew
  - Right tail
    - We will only do right-tail tests
  - Depends on df

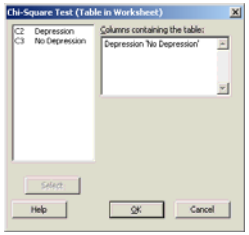


Perform the Test of Homogeneity

- Is the distribution the same across all drugs?
- Hypotheses – write out words (not symbols)
- Model

χ^2 – Test in Minitab

- Enter the table in Minitab
  - Already done
- Stat > Tables > Chi-Square Test (Two-way Table in Worksheet)
  - Columns containing the table: List all columns with the count data



Just Checking…

Chi-Square Test: Depression, No Depression

Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

	Depression	No Depression	Total
1	24	6	30
	20.00	10.00	
	0.800	1.600	
2	22	8	30
	20.00	10.00	
	0.200	0.400	
3	14	16	30
	20.00	10.00	
	1.800	3.600	
Total	60	30	90

Chi-Sq = 8.400, DF = 2, P-Value = 0.015

TEST STATISTIC DF P-VALUE

DOUBLE CHECK DATA ENTRY

CHECK EXPECTED CELL FREQUENY CONDITION

- Conclusions?

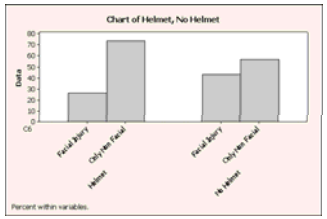
Tests of Independence

- In a **test of independence**, we will test
  - the null hypothesis that there is no association between the two variables (or that the variables are **independent**) against
  - the alternative hypothesis that there is an association (or that the variables are **dependent**)
- To conduct this test, we again calculate the **χ^2 statistic** and compare it to the χ^2 model!
  - Same conditions for use as the test of homogeneity.
  - The only change (for us) is how we phrase the null and alternative.

Example: Bicycle Helmets

	Helmet Worn	No Helmet
Facial Injuries	30	182
Only non facial injuries	83	236

- A study was conducted of 531 persons injured in bicycle crashes.
- Determine if there is sufficient evidence to conclude that receiving facial injuries is independent of wearing a helmet.

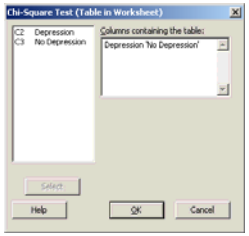


Perform the Test of Independence

- Are they independent?
- Hypotheses – write out words (not symbols)
- Model

χ^2 – Test in Minitab

- Enter the table in Minitab
  - Already done
- Stat > Tables > Chi-Square Test (Two-way Table in Worksheet)
  - Columns containing the table: List all columns with the count data



Just Checking…

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Chi-Square Test: Helmet, No Helmet

Expected counts are printed below observed counts
Chi-Square contributions are printed below expected counts

       Helmet  No Helmet  Total
1          30        182    212
        45.11     166.89
        5.064      1.369

2          83        236    319
        67.89     251.11
        3.365      0.910

Total     113        418    531

Chi-Sq = 10.708, DF = 1, P-Value = 0.001
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DOUBLE CHECK DATA ENTRY

CHECK EXPECTED CELL FREQUENY CONDITION

TEST STATISTIC DF P-VALUE

- Conclusions?
- Interpret p-value:

Class Work

- To get credit, it is your responsibility to get checked off.
  1. Chapter 26 Handout
     - Checking solutions? No pens in the front!

Homework

- Textbook/Routine Homework
  - Due Next Week (25% chance of collection)
  1. Read Chapter 26
  2. Pg : #1, 13, 14, 25(a-e), 27(a-g), 29, 31, 33, 35
- Project 3
  - Due the Last Day of Class