

LAB SESSION 11 – CATEGORICAL DATA ANALYSIS

Analytics Primer

TESTS AND MEASURES OF ASSOCIATION

Example

- A drug manufacturer wants to determine if there is a difference between the effectiveness of their new cough medicine (called A) and the current best selling cough medicine (called B). To do this they sampled people who took both cough medicines regularly and counted how many still had a cough after 3 days. Use the following table to answer the next eight questions.

	Cough after 3 Days	No Cough after 3 Days	Total
Medicine A	16	84	100
Medicine B	29	71	100
Total	45	155	200

Example

1. What is the expected cell value for people who took medicine A and still had a cough after 3 days?

OBSERVED	Cough after 3 Days	No Cough after 3 Days	Total
Medicine A	16	84	100
Medicine B	29	71	100
Total	45	155	200

EXPECTED	Cough after 3 Days	No Cough after 3 Days	Total
Medicine A	$\frac{45}{200} \times 100 = 22.5$	$\frac{155}{200} \times 100 = 77.5$	100
Medicine B	$\frac{45}{200} \times 100 = 22.5$	$\frac{45}{200} \times 100 = 77.5$	100
Total	45	155	200

Example

2. What is the Pearson Chi-squared test statistic for this problem?

$$\frac{(16 - 22.5)^2}{22.5} + \frac{(29 - 22.5)^2}{22.5} + \frac{(84 - 77.5)^2}{77.5} + \frac{(71 - 77.5)^2}{77.5} = 4.846$$

Example

3. What is the value of the Likelihood Ratio Chi-squared test statistic for this problem?

$$2 \times \left(16 \times \log\left(\frac{16}{22.5}\right) + 29 \times \log\left(\frac{29}{22.5}\right) + 84 \times \log\left(\frac{84}{77.5}\right) + 71 \times \log\left(\frac{71}{77.5}\right) \right) = 4.901$$

Example

4. What is the probability that a randomly selected person in this study who took medicine A had no cough?

$$\frac{84}{100} = 0.84$$

Example

5. What are the odds that someone who took medicine A does not have a cough?

$$\frac{0.84}{0.16} = 5.25$$

Example

6. What is the odds ratio of people not having a cough between people who took medicine A compared to B?

$$\frac{\left(\frac{0.84}{0.16}\right)}{\left(\frac{0.71}{0.29}\right)} = 2.144$$

Example

7. Calculate Cramer's V for this problem.

$$\sqrt{\frac{\left(\frac{4.846}{200}\right)}{1}} = 0.156$$