HSCC 470
Research Methods and Data Analysis in Health Sciences

Using SPSS: The Chi Square Test

Unit Objectives

Upon completion of this unit, the student will be able to:

- List the assumptions of the chi square test.
- Describe when the chi square test is appropriate for testing a hypothesis.
- Discuss the special circumstances when variations of the chi square test, such as Yates correction and Fisher's exact test, should be used.
- Use SPSS to conduct a chi square test and correctly interpret the output.

Statistical Methods to Test Hypotheses

Scale of Measurement	Two Treatment Groups Consisting of Different Individuals	Three or More Treatment Groups Consisting of Different Individuals	Before and After a Single Treatment in the Same Individuals	Association Between Two Variables
Interval	Unpaired *t* test	ANOVA	Paired *t* test	Linear Regression and Pearson Correlation
Nominal	Chi-square	Chi-square	McNemar's test	Contingency Coefficients
Ordinal	Mann-Whitney rank-sum test	Kruskal-Wallis statistic	Wilcoxon signed-rank test	Spearman Rank Correlation

Assumptions of the Chi Square Test

- Frequency data
- Data measured on nominal level
- 2 or more groups are being compared
- The groups are independent
- Data need not be drawn from a normally distributed population
- Comparing frequencies or proportions
- For 2 X 2 tables, expected frequency (F_e) ≥ 5 in all cells
- For larger tables, F_e ≥ 5 in at least 75% of cells, and F_e ≥ 1 in remaining cells

Special Circumstances with Chi Square

- 2 X 2 contingency tables
- "An AAS degree in EMS should be the minimum entry level qualification for a paramedic in NC."

	Agree	Disagree
Hold Degree	24	12
No Degree	6	18

- Use Yates correction (continuity correction) for 2 X 2 tables.

Special Circumstances with Chi Square

	Agree	Disagree	Row Total
Hold Degree	24	12	36
No Degree	6	18	24
Column Total	30	30	60

- F_e (agree who hold degree) = (36 X 30)/60 = 18
- When the expected frequencies (F_e) of a 2 X 2 table are less than 5, use Fisher's exact test.

Misuses of the Chi Square Test

- Failure to describe exactly how the data were categorized and the analysis performed
- Using the Chi Square when the F_e are too small
- Computing the Chi Square for percentages rather than the actual frequencies
- Categories are not mutually exclusive
- Using Chi Square to detect association when the variables are ordinal or interval level.

Conducting a Chi Square Test Using SPSS continued

- **Assumptions**
  - Scale of measurement
    - Nominal or ordinal
  - Population distribution
    - Any distribution
  - Method of sampling
    - Randomized, 2 or more independent samples
  - Sample size
    - Certificate N = 23
    - AAS N = 26
    - BS N = 23

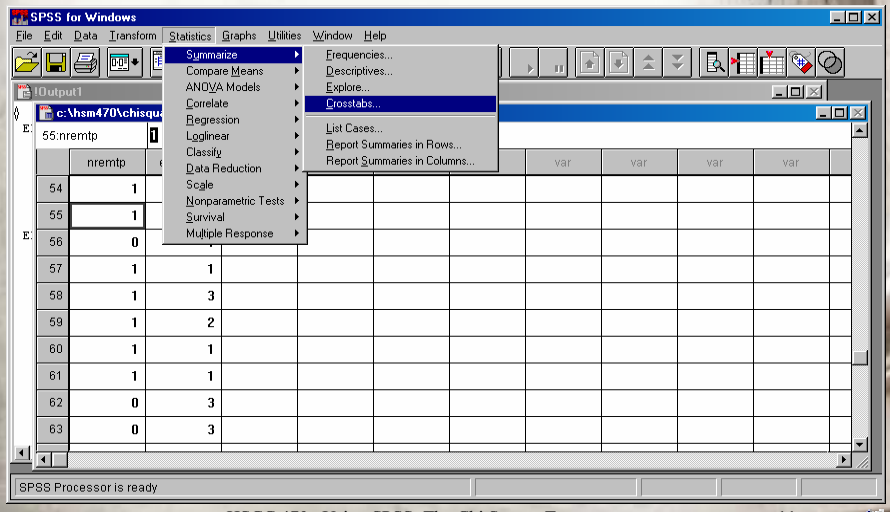
Conducting a Chi Square Test Using SPSS continued

- **Hypotheses**
  - Null
    - There is no difference in the pass rates on the NREMT-P practical exam among certificate, AAS, or BS degree paramedics.
  - Alternative
    - There is a difference in the pass rates on the NREMT-P practical exam among certificate, AAS, or BS degree paramedics.
  - Select Alpha Level
  - Alpha = 0.05
- **Test statistic**
  - Chi Square

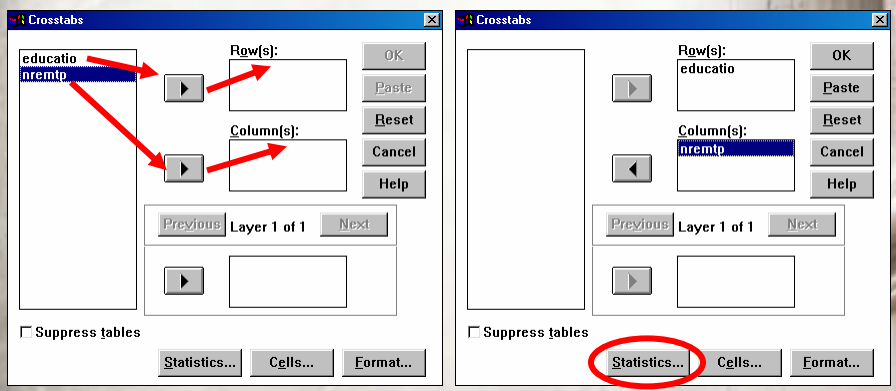
Conducting a Chi Square Test Using SPSS continued

- ***P*-value**
- **Conclusion**

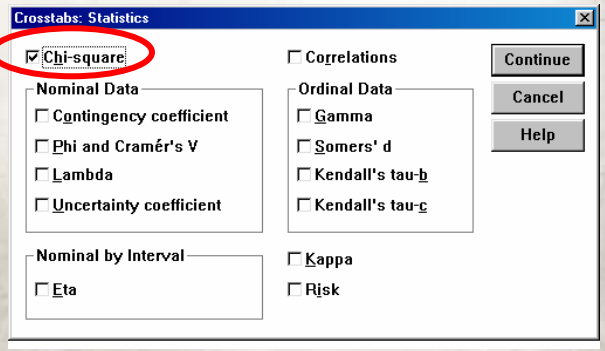
Conducting a Chi Square Test Using SPSS



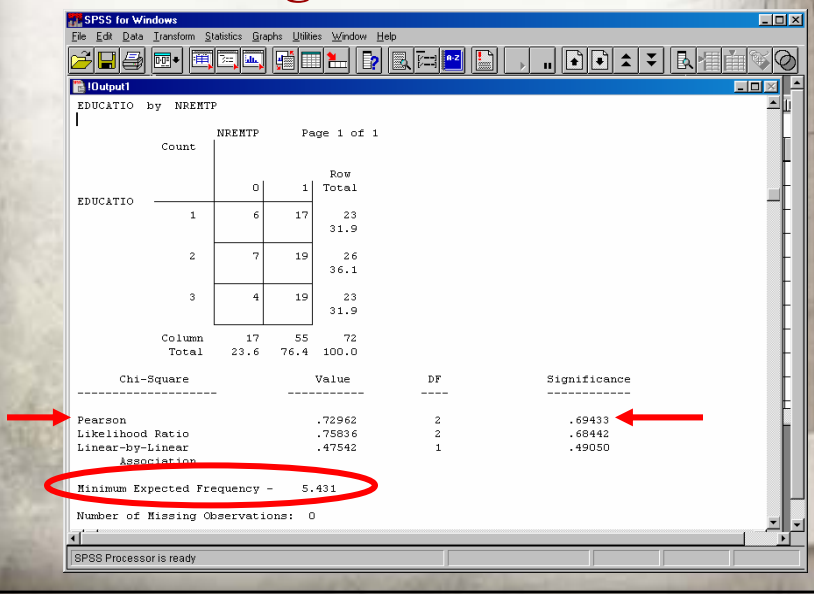
Conducting a Chi Square Test Using SPSS continued



Conducting a Chi Square Test Using SPSS continued



Conducting a Chi Square Test Using SPSS continued



Conducting a Chi Square Test Using SPSS continued

- *P*-value
  - ***P*** = 0.6943
- **Conclusion**
  - *P* value is greater than alpha. Therefore, we cannot reject the null hypothesis and conclude that there is no difference in pass rates on the NREMT-P practical exam among certificate, AAS, or BS paramedics.

Yates Correction and Fisher's Exact Test

	Agree	Disagree	Row Total
Hold Degree	**24**	**12**	**36**
No Degree	**6**	**18**	**24**
Column Total	**30**	**30**	**60**

- **For 2 X 2 contingency tables, use Yates correction.**
- **When the expected frequencies (F_e) of a 2 X 2 table are less than 5, use Fisher's exact test.**

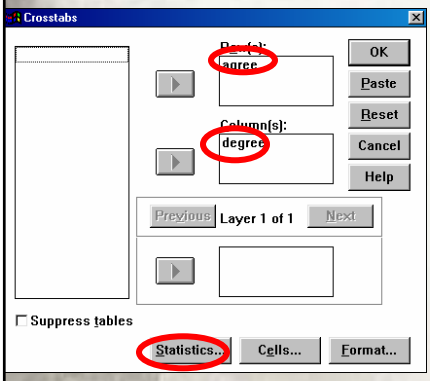
Yates Correction and Fisher's Exact Test continued

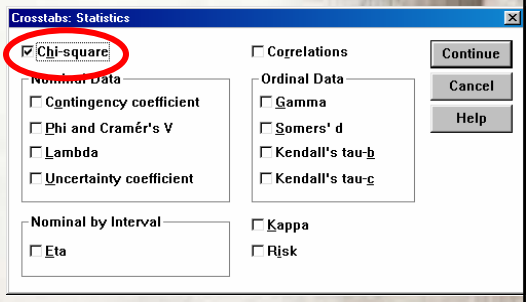
- **Hypotheses**
  - Null
    - There is no difference in the proportions of paramedics who favor AAS degrees as an entry level requirement, based upon whether or not they themselves hold a degree.
  - Alternative
    - There is a difference in the proportions of paramedics who favor AAS degrees as an entry level requirement, based upon whether or not they themselves hold a degree.
    - Select Alpha Level
  - Alpha = 0.05
- **Test statistic**
  - Chi Square

Yates Correction and Fisher's Exact Test continued

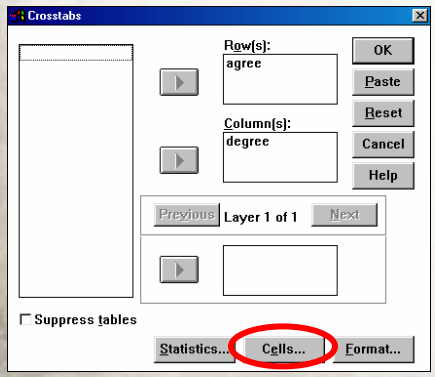
- ***P*-value**
- **Conclusion**

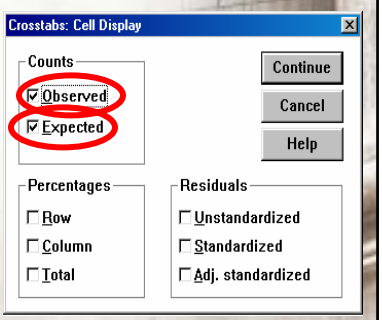
Yates Correction and Fisher's Exact Test continued



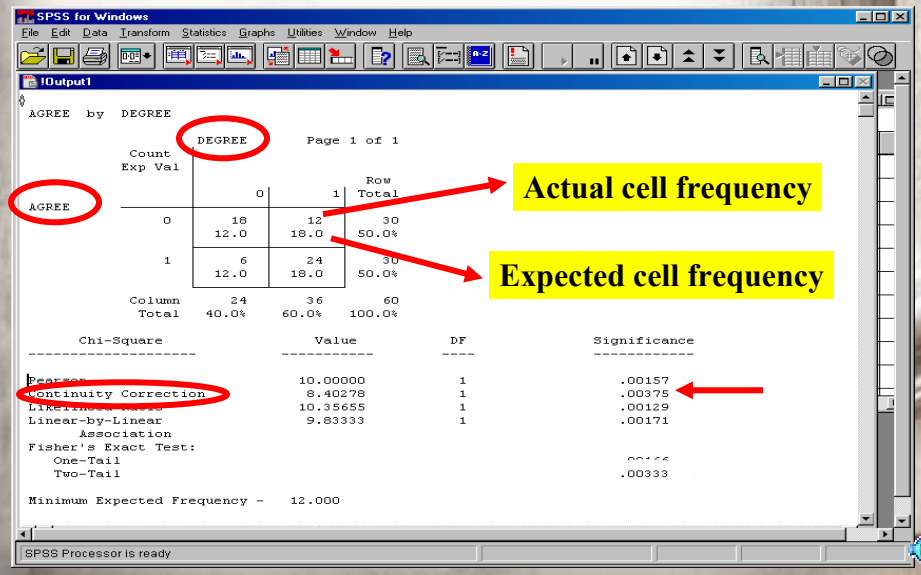


Yates Correction and Fisher's Exact Test continued





Yates Correction and Fisher's Exact Test continued



Yates Correction and Fisher's Exact Test continued

- *P*-value
  - ***P*** = 0.0037
- **Conclusion**
  - *P* value is less than alpha. Therefore, we can reject the null hypothesis and conclude that there is a difference in the proportion of paramedics who favor requiring a degree, based upon whether or not they themselves hold a degree.

Summary of Chi Square Interpretation

- **Meets assumptions**
- **Evaluate minimum expected cell frequency**
- **If $F_e < 5$ for any cell, use Fisher's Exact Test**
- **For 2X2 tables, use continuity correction**
- **All others, use Pearson Chi square**