Unit Objectives

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

- List the assumptions of the McNemar test.
- Describe when the McNemar test is appropriate for testing a hypothesis.
- Use SPSS to conduct a McNemar test and correctly interpret the output.

Statistical Methods to Test Hypotheses

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

Assumptions of the McNemar Test

- Comparing frequencies or proportions
- Data measured on nominal level
- 1 group being compared before and after a treatment or intervention
- The groups (before and after) are the same individuals and therefore are dependent
- May be used as a measure of inter-rater agreement of scoring the same individuals
- Data need not be drawn from a normally distributed population

Examples of McNemar’s Test

- 2 X 2 contingency tables
- Inter-rater agreement on ACLS Megacode

<table>
<thead>
<tr>
<th></th>
<th>Pass</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examiner 1</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Examiner 2</td>
<td>20</td>
<td>16</td>
</tr>
</tbody>
</table>

Examples of McNemar’s Test

- 2 X 2 contingency tables
- Before and after test in the same individuals
- Analogous to paired t test, but used for nominal level data

<table>
<thead>
<tr>
<th></th>
<th>Pass</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Post-test</td>
<td>20</td>
<td>16</td>
</tr>
</tbody>
</table>
Conducting McNemar’s Test Using SPSS continued

- Assumptions
  - Scale of measurement
    - Nominal
  - Population distribution
    - Any distribution
  - Method of sampling
    - Randomized, 1 dependent sample

Conducting McNemar’s Test Using SPSS continued

- Hypotheses
  - Null
    - There is no difference in the pass rates on the NREMT-P practical exam between two evaluators evaluating the same registry candidates
  - Alternative
    - There is a difference in the pass rates on the NREMT-P practical exam between two evaluators evaluating the same registry candidates
  - Select Alpha Level
    - Alpha = 0.05

- Test statistic
  - McNemar

Conducting McNemar’s Test Using SPSS continued

- $P$-value
  - Conclusion
Conducting McNemar’s Test Using SPSS continued

• \( P \)-value
  – \( P = 0.1892 \)

• Conclusion
  – \( P \) value is greater than alpha. Therefore, we cannot reject the null hypothesis and conclude that there is no difference in the pass rates on the NREMT-P practical exam between two evaluators evaluating the same registry candidates.

Conducting McNemar’s Test Using SPSS continued

• Hypotheses
  – Null
    • There is no difference in the proportion of paramedics favoring an AAS degree requirement before and after receiving their degree.
  – Alternative
    • There is a difference in the proportion of paramedics favoring an AAS degree requirement before and after receiving their degree.

• Select Alpha Level
  – Alpha = 0.05

• Test statistic
  – McNemar

Conducting McNemar’s Test Using SPSS continued

• \( P \)-value
  – \( P = 0.0085 \)

• Conclusion
  – \( P \) value is less than alpha. Therefore, we reject the null hypothesis and conclude that there is a difference in the proportion of paramedics favoring an AAS degree requirement before and after receiving their degree.