Unit Objectives

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

– List the assumptions of the Wilcoxon Signed Rank test.
– Describe when the Wilcoxon Signed Rank test is appropriate for testing a hypothesis.
– Use SPSS to conduct a Wilcoxon Signed Rank 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>Kruskal-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 Wilcoxon Signed Rank Test

- Ranked data
- Data measured on an ordinal level
- Only 2 groups are being compared
- The groups are dependent
- Data need not be drawn from a normally distributed population
- Comparing ranks
- May be used on interval level data when assumptions of paired t-test have been violated (e.g., data are not normally distributed)

Examples of the Wilcoxon Signed Rank Test

- Test for differences in paired (dependent) samples measured on an interval scale when normality assumption is violated.

Examples of the Wilcoxon Signed Rank Test continued

- Test for differences in paired (dependent) samples when data are ordinal level
  - Would you be willing to perform CPR on a total stranger?

<table>
<thead>
<tr>
<th>Patient #</th>
<th>Before Drug</th>
<th>After Drug</th>
<th>Difference</th>
<th>Rank of Difference</th>
<th>Signed Rank Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1800</td>
<td>1400</td>
<td>400</td>
<td>2</td>
<td>-2</td>
</tr>
<tr>
<td>2</td>
<td>1300</td>
<td>1400</td>
<td>100</td>
<td>4</td>
<td>+4</td>
</tr>
<tr>
<td>3</td>
<td>1600</td>
<td>1400</td>
<td>200</td>
<td>5</td>
<td>+5</td>
</tr>
<tr>
<td>4</td>
<td>1800</td>
<td>1400</td>
<td>400</td>
<td>2</td>
<td>-2</td>
</tr>
<tr>
<td>5</td>
<td>1400</td>
<td>1300</td>
<td>100</td>
<td>4</td>
<td>+4</td>
</tr>
<tr>
<td>6</td>
<td>1010</td>
<td>1000</td>
<td>10</td>
<td>1</td>
<td>+1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Respondent #</th>
<th>Before Video</th>
<th>After Video</th>
<th>Difference</th>
<th>Rank of Difference</th>
<th>Signed Rank Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-1</td>
<td>3</td>
<td>+3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>+1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>+1</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>3</td>
<td>-1</td>
<td>3</td>
<td>-3</td>
</tr>
</tbody>
</table>
Conducting a Wilcoxon Signed Rank Test Using SPSS

- **Assumptions**
  - Scale of measurement
    - Ordinal or higher
  - Population distribution
    - Any distribution
  - Method of sampling
    - Randomized, 2 dependent samples
  - Sample size
    - Before: N = 50
    - After: N = 50
    - (same individuals)

- **Hypotheses**
  - Null
    - There is no difference in paramedics’ attitude toward on-line learning before and after taking an on-line course.
  - Alternative
    - There is a difference in paramedics’ attitude toward on-line learning before and after taking an on-line course.
  - Alpha = 0.05

- **Test statistic**
  - Wilcoxon signed rank test

- **P-value**

- **Conclusion**

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To what extent do you agree with the following statement?

- In terms of mastery of content, on-line learning is equivalent to traditional classroom learning.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

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Conducting a Wilcoxon Signed Rank Test Using SPSS

- Scale of measurement
- Ordinal or higher
- Population distribution
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- Sample size
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- After: N = 50
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Conducting a Wilcoxon Signed Rank Test Using SPSS

- \( P \)-value
  - \( P = 0.9494 \)

- Conclusion
  - \( P \) value is greater than alpha. Therefore, we cannot reject the null hypothesis and conclude that there is not a difference in paramedics’ attitudes towards on-line learning before and after taking an on-line course.