

Chi-Square and Wilcoxon Signed-Rank Tests

Practical 15 | Pharmacology III

Aim

To study Chi-Square and Wilcoxon Signed-Rank Tests, and interpret the recorded observations.

Principle

- A chi-square independence test analyzes categorical counts. A Wilcoxon signed-rank test uses ranks of paired differences and requires the appropriate paired-data and symmetry assumptions for a location-shift interpretation.
- Choose the calculation or statistical model appropriate to the data structure and assumptions.
- Units, paired or independent observations, and the direction of the measured effect must be explicit.

Materials and Apparatus

- Provided contingency table or paired measurements and statistical software.
- Instructor-provided dataset and the stated study/model assumptions.
- Calculator or spreadsheet/statistical software and a record sheet.

Method

1. Choose the test from the data structure and the stated question.
2. For chi-square, construct the count table and calculate expected counts under independence.
3. Check expected-count adequacy and consider a suitable exact alternative where needed.
4. For signed ranks, compute paired differences, handle zeros by the specified convention and rank nonzero absolute differences with averaged ties.
5. Calculate the statistic or obtain it with verified software settings and record the exact/asymptotic approach.
6. Report the result and the assumptions supporting the interpretation.

Observation Record

Complete this record using actual laboratory findings or the provided teaching data.

Observation / parameter	Record / finding
Observed/expected counts	_____
Paired differences	_____
Ranks and ties	_____
Statistic	_____
Degrees of freedom or method	_____
p-value	_____

Calculations and Interpretation

- Expected cell count = row total $\times$ column total/grand total.
- Chi-square = $\sum[(\text{observed} - \text{expected})^2 / \text{expected}]$; table degrees of freedom = (rows - 1)(columns - 1).
- Wilcoxon: sum ranks separately for positive and negative nonzero differences; state the statistic convention used by the software.

Result

Record the actual finding, calculated value with units where relevant, and a conclusion supported by the observations.

Finding: _____

Conclusion: _____

Precautions

- Do not interchange paired and independent analyses.
- Keep unit conversions explicit and round at the final reporting stage.
- A model estimate or p-value does not by itself establish a causal or clinical conclusion.

Viva Questions

1. Is the Wilcoxon signed-rank test the same as the rank-sum test?

No. Signed ranks analyze paired differences; rank-sum methods compare independent groups.

2. Why state assumptions?

An equation or test can give a misleading answer when its underlying assumptions do not hold.

3. Why keep intermediate calculations?

They make the result reproducible and expose unit or transcription errors.

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