European Menopause and Andropause Society (EMAS)   Research Resources

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Parametric versus nonparametric statistical tests

> Parametric tests make assumptions about the distribution of the data, but nonparametric tests do not.

Parametric tests

The appropriate use of parametric tests requires two key *assumptions* to be made about the data:

- The data are normally distributed
- There is homogeneity of variance (i.e. equal variance across groups)

Parametric tests offer the following *advantages*:

- Higher statistical power
- Efficient with large sample sizes
- Direct interpretation of the parameter estimates
- Use of quantitative data

Parametric tests have the following *disadvantages*:

- The above assumptions need to be made
- May be sensitive to outliers
- Do not work well with some types of data, such as ordinal or categorical data

Common parametric tests for different data types

- Independent samples *t*-test: compares two independent groups
- Paired samples *t*-test: compares two sets of dependent observations or measurements
- Analysis of variance (one-way ANOVA): compares three or more independent groups
- Pearson correlation coefficient (*r*): estimates the linear association between two quantitative variables

Nonparametric tests

Nonparametric tests offer the following *advantages*:

- No assumptions need to be made about the data
- Flexible to different data types, such as ordinal or categorical data
- Robust to outliers
- Can be used with small sample sizes

Nonparametric tests have the following *disadvantages*:

- Less powerful when parametric assumptions are met
- Less precise because they are based on ranks
- May be harder to interpret because they are based on ranks

Common nonparametric tests for different data types

- Mann–Whitney *U* test: compares two independent groups.
- Wilcoxon signed rank test: compares two dependent groups
- Kruskal–Wallis test: compares three or more independent groups.
- Spearman's rank correlation (rho): estimates monotonal association between two quantitative variables
- Chi-square test: compares two independent categorical variables
- McNemar test: compares two paired/matched dichotomous variables

> In parametric tests, information about the distribution of the study population is known.

> In nonparametric tests, information about the distribution of the study population is unknown.

Further information

Statistics How To   https://www.statisticshowto.com/

BMJ. **Statistics notes**   https://www.bmj.com/specialties/statistics-notes