The following resources are associated: Terminology for choosing the right test

Choosing the right test (Advanced)

The following tables contain most common statistical tests. The first table looks at techniques for testing for differences, the second looks at general relationships between two variables and the third at techniques for investigating relationships with a clear dependent variable.

Testing for differences (t-tests, ANOVA’s and non-parametric tests)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Testing means** | **1st Independent (explanatory ) variable** | **2nd Independent (explanatory) variable** | **Parametric test (scale dependent)** | **Non-parametric (Ordinal/ skewed data)** |
| **Tests for comparing independent groups** |
| Testing for differences between two independent groups | Binary (groups) |  | Independent t-test | Mann-Whitney test (Wilcoxon rank sum) |
| Testing for differences between 3+ independent groups | Nominal (groups) |  | One-way ANOVA | Kruskall-Wallis test |
| Testing for differences for two different between groups independent variables and their combined effect  | Nominal (groups) | Nominal (groups) | Two-way ANOVA |  |
| Testing for differences between 3+ independent groups whilst controlling for a covariate (numerical independent) | Nominal (groups) | Scale | ANCOVA |  |
| Several scale dependent variables: Investigating the effect of one nominal independent variable on a group of related scale dependent variables.  | Nominal (groups) |  | MANOVA |  |
| **Tests involving repeated measurements of the same dependent variable**  |
| Testing paired differences of two measurements of the same variable on the **same subject e.g. weight before/**after a diet | Binary Time/ Condition variable |  | Paired t-test | Wilcoxon signed rank test |
| Testing differences in 3+ measurements of the same variable on the same subject | Nominal Time/ condition variable |  | Repeated measures ANOVA | Friedman test |
| Testing the differences in the averages for two different within groups independent variables and their combined effect  | Nominal Time/ Condition variable | Nominal Time/ Condition variable | Two-way repeated measures ANOVA |  |
| One within and one between groups factor | Nominal (groups) | Nominal Time/ Condition variable | Mixed ANOVA |  |

All of the tests in the ‘Parametric’ column of the ‘Testing means’ table require that the dependent (outcome) variable is scale (numerical) and that the assumptions of the suggested test have been met. If your dependent variable is ordinal, or the assumptions of the test are not met, use the tests in the ‘Non-parametric’ column. Decide whether you have repeated measurements of the same dependent variable or whether you are comparing independent groups and choose the correct section. Scale data is also known as numerical, quantitative or continuous.

Example research question: Does Margarine A reduce cholesterol?

Dependent = Cholesterol (scale), Independent = 3 time points (before, after 4 weeks and after 8 weeks), Parametric test = Repeated measures ANOVA. Run the test and check the assumptions. If the assumption of normality is not met, use a Friedman test. If Margarines A and B are being compared and participants can only have either Margarine A or B, a mixed ANOVA is appropriate as there is one independent group variable (the Margarine) and one within groups variable (time).

Investigating relationships

When investigating relationships, think about whether there are clear dependent (outcome) and independent (explanatory) variables or whether you are looking for general relationships or patterns.

|  |
| --- |
| Investigating general relationships between two or more variables |
| **Description** | Dependent (outcome) variable | Independent (explanatory) variable | Technique |
| Measuring the strength of the relationship between 2 numerical variables | Numerical (no dependent needs to be specified) | Pearson’s Correlation Coefficient |
| Measuring the strength of the relationship between 2 ordinal variables | Ordinal (no dependent needs to be specified) | Spearman’s Correlation, Kendall’s tau  |
| Testing for an association between two Nominal variables | Two Nominal (no dependent needs to be specified) | Chi-squared test |
| Testing for an association between two Ordinal variables | Two Ordinal (no dependent needs to be specified) | Linear-by-linear association (part of Chi-squared options) |
| Testing for an association between 3+ Nominal variables | 3+ Nominal (no dependent needs to be specified) | Log-linear analysis |
| Grouping similar variables or subjects  | Any | Cluster analysis |
| Reducing a number of variables into a few linear combinations  | Scale/binary/ordinal | Principal Components analysis |
| Identifying underlying latent variables in a set of measured variables | Numerical/binary/ordinal | Factor analysis |

The following methods can be used to look for significant relationships between one dependent variable and one or more independent variables. Each method also allows prediction of the dependent variable using a mathematical equation (model).

|  |
| --- |
| **Quantifying relationships with one clear dependent and any number of scale or binary independents** |
| **Description** | Dependent | Independent(s) | Technique |
| Quantifying relationships and/or predicting values of a numerical dependent  | Scale (Numerical)  | Scale/ Binary | Linear regression |
| Quantifying relationships and/or predicting values of a dependent representing counts or rates | Discrete (Count data) | Scale/ Binary | Poisson regression  |
| Quantifying relationships and/or predicting values of a binary dependent | Binary | Scale/ Binary | Binary logistic regression  |
| Quantifying relationships and/or predicting values of a dependent representing time to an event | Event occurrence e.g. survival | Scale/ Binary | Survival analysis (Cox’s regression)  |
| Quantifying relationships and/or predicting values of an ordinal dependent | Ordinal | Scale/ Binary | Ordinal logistic regression  |
| Quantifying relationships and/or predicting values of a nominal dependent | Nominal | Scale/ Binary | Multinomial logistic regression  |
| Classification of individuals into groups  | Nominal (Group identifier) | Scale/ Binary | Linear discriminant analysis |

You may also wish to test for agreement rather than look for differences.

|  |
| --- |
| Measuring agreement or reliability |
| **Description** | Dependent (outcome) variable | Independent (explanatory) variable | Technique |
| Assessing the reliability of a set of questions to consistently measure an underlying latent variable | Several ordinal questions (items) which form a scale to measure an underlying variable | Cronbach’s Alpha |
| Measuring agreement between methods or observers for numerical outcomes | Scale (repeated measurements) | Nominal (methods or observers) | Intraclass correlation |
| Measuring agreement between methods or observers for nominal outcomes | Nominal (repeated measurements) | Binary (methods/ observers) | Cohen’s kappa |
| Measuring agreement between methods or observers for ordinal outcomes | Ordinal (repeated measurements) | Binary (methods/ observers) | Weighted kappa |