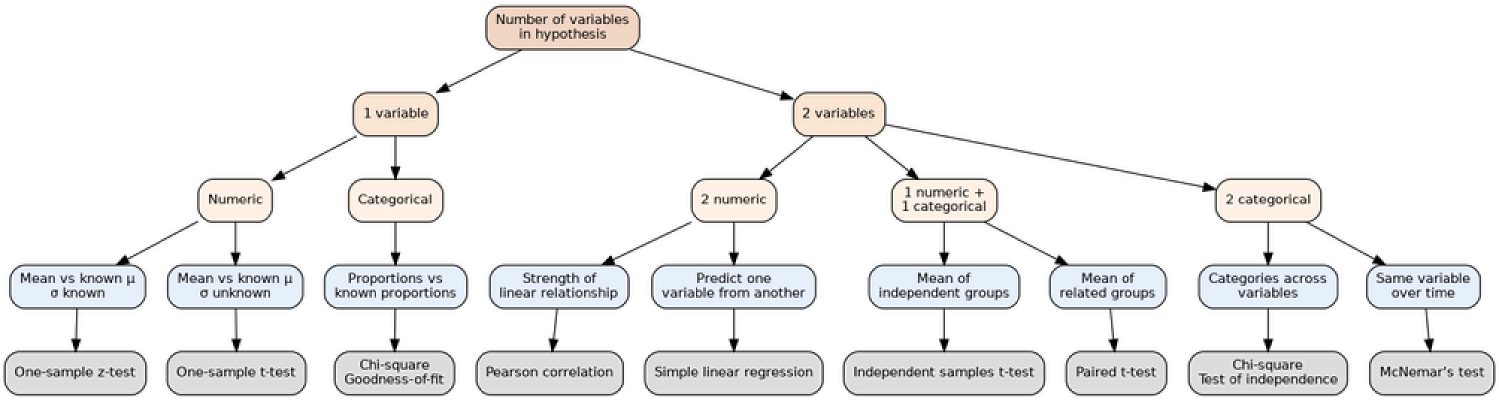

Test Assumption Checks

One sample z-test	Normality Histogram Shapiro- Wilk test
One sample t-test	Normality Histogram Shapiro- Wilk test
Two sample t-test	Normality of each group Histogram Shapiro- Wilk test Equality of variances Levene's test
Correlation (Pearson)	Check scatter plot for linear relationship
Chi- Squared Goodness of Fit Test	Expected values ≥ 5

Research Designs

	Non-Experimental	True Experimental	Quasi-Experimental	Between-Subjects	Within-Subjects
Manipulation	No	Yes	Yes	Depends on study	Depends on study
Random Assignment	No	Yes	No	Yes (if true experiment)	Yes (if true experiment)
Causality?	No	Yes	Limited	–	–
Group Structure	Naturally occurring groups	Randomly assigned groups	Pre-existing groups	Different participants per condition	Same participants in all conditions
Internal Validity	Low	High	Moderate	Varies	High control over individual differences
External Validity	High	Lower (lab settings)	Higher than true experiments	Varies	Varies
Key Risk	Confounding variables	Artificial setting	Selection bias	Individual differences	Order / practice effects

Effect Size Interpretation Guide

Size of effect	Cohen's d	Pearson's r	Cohen's W	Regression (approx.)
Negligible	<0.2	<0.1	<0.1	t ≤ 1.5 p ≥ 0.5 $R^2 \leq 0.02$
Small	0.2 – 0.5	0.1 – 0.3	0.1 – 0.3	t = 2–3 p ≤ 0.05 $R^2 = 0.02 – 0.13$
Moderate	0.5 – 0.8	0.3 – 0.5	0.3 – 0.5	t > 3 p ≤ 0.01 $R^2 = 0.13 – 0.26$
Large	> 0.8	> 0.5	> 0.5	t > 5 p ≤ 0.001 $R^2 \geq 0.26$

VARIABLE TYPE	CATEGORICAL	NUMERICAL	
CATEGORICAL	CLUSTERED BAR CHART	COMPARATIVE BOX PLOT	BAR CHART/ PIE CHART
NUMERICAL	COMPARATIVE BOX PLOT	SCATTER PLOT	HISTORGRAM

Criteria for cause and effect

- **Covariance:** The variables must be related.
- **Temporal precedence:** The cause must occur before the effect (longitudinal designs can establish this).
- **Internal validity:** Alternative explanations for the effect are ruled out.
- **External validity:** The extent to which findings generalise beyond the study; higher real-world applicability often reduces experimental control and increases influence of outside factors.

Type I Error (False Positive)
Rejecting a true null hypothesis
Concluding there is an effect when none exists (chance result)
Type II Error (False Negative)
Failing to reject a false null hypothesis
Missing a real population effect

Ethics
Informed consent: Participants understand the study and risks before agreeing
Limited disclosure: Some details withheld to avoid bias
Deception: Misleading participants only when necessary
Debriefing: Full explanation given after participation
Voluntary participation: No coercion; participation is optional

Discrete: Whole numbers only.
Continuous: Can take any value (including decimals).
Nominal: Categorical, no order.
Ordinal: Categorical, ordered.
Interval: Numeric scale with equal intervals, no true zero (e.g., pain rated 0–10).
Ratio: Numeric scale with equal intervals and a true zero (e.g., distance between A and B).

Hypothesis Test	Statistical Hypotheses	df	Standardised Effect Size	STATA
One-sample z-test	H_0: $\mu = \mu_0$ H_1: $\mu \neq \mu_0$	N/A	Cohen’s d = $(M - \mu_0) / \sigma$	**ztest var == mu, sd(sigma)**
One-sample t-test	H_0: $\mu = \mu_0$ H_1: $\mu \neq \mu_0$	$n - 1$	Cohen’s d = $(M - \mu_0) / s$	**ttest var == mu**
Two-sample t-test (independent)	H_0: $\mu_1 = \mu_2$ H_1: $\mu_1 \neq \mu_2$	$n_1 + n_2 - 2$	Cohen’s d = $(\bar{X}_1 - \bar{X}_2) / s_p$ given	**ttest var, by(group)**
Paired t-test	H_0: $\mu d = 0$ H_1: $\mu d \neq 0$	$n - 1$	Cohen’s d = Md / sd	**ttest var == var2**
Correlation (Pearson’s r)	H_0: $\rho = 0$ H_1: $\rho \neq 0$	$n - 2$	r (also the effect size)	**pwcorr var var2**
Simple linear regression	H_0: $\beta = 0$ H_1: $\beta \neq 0$	$n - 2$	R^2 or standardized β	**regress var var2**
Chi squared goodness of fit (1 categorical variable)	H_0: $p_1 = p_2 = \ldots = p_k$ H_1: proportions differ	$k - 1$	Cohen’s W = $\sqrt{\chi^2 / N}$	**tabulate var, chi2**
Chi squared test of independence (2 categorical variables)	H_0: no association between variables H_1: association exists	(rows − 1) x (columns − 1)	Cohen’s W = $\sqrt{\chi^2 / N}$	**tabulate var group, chi2**
McNemar’s test	H_0: pbefore = pafter H_1: pbefore ≠ pafter	1	Cohen’s W = $\sqrt{\chi^2 / N}$	**mcc var var2**

Expected Value for Chi-Square Test of Independence

$$E = \frac{\text{Row Total} \times \text{Column Total}}{\text{Grand Total}}$$

E.g. Finding E for university students who own dogs and major in psychology

	Own Dog	Own Cat	Own Neither	Total
Psychology	103	74	123	300
Business	86	110	79	275
Engineering	131	80	97	308
Column Total	320 264	264	299	883

$$E_{Psychology,\ Dog} = \frac{300 \times 320}{883}$$

$$E_{p,d} = \frac{300 \times 320}{883}$$

Calculating Z-score

A Z-score indicates how many standard deviations an observation is from the mean. It converts values to a standard normal scale.

$$z = \frac{\text{observed score} - \mu}{\sigma}$$

Reliability	Consistency of a measure	Same results repeatedly
Test–retest	Stable over time	Time consistency
Internal consistency	Items measure same construct	Items agree
Validity	Accuracy of a measure	Measuring the right thing
Face validity	Looks correct	“Looks right”
Content validity	Covers full construct	“Covers everything”
Criterion validity	Correlates with related measure	“Matches what it should”

Assumption Checks

Shapiro–Wilk	Is the DV normally distributed?	Needed for parametric tests (e.g., t-tests)
Levene’s Test	Are group variances equal?	Assumption for independent t-test
95% Confidence Interval	Likely range of true population value	Narrower with larger sample