

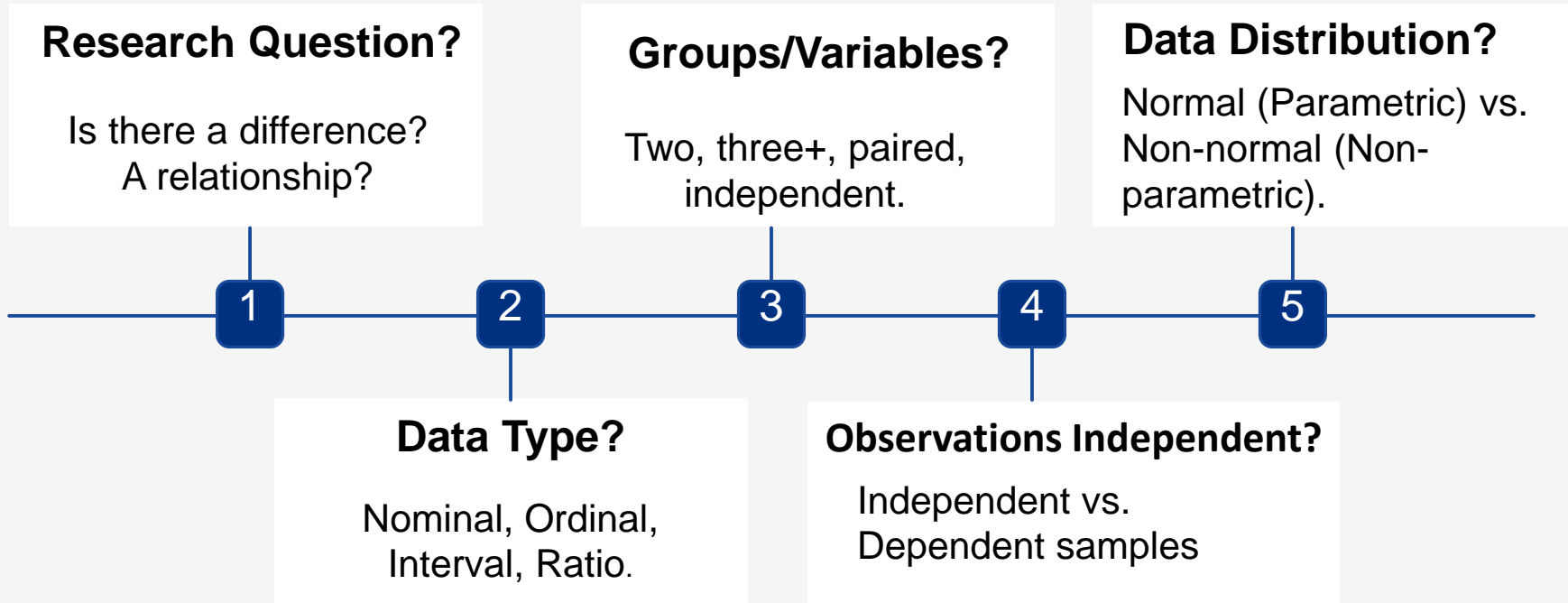
# Choosing the Right Statistical Test

A Framework for Making Informed Decisions

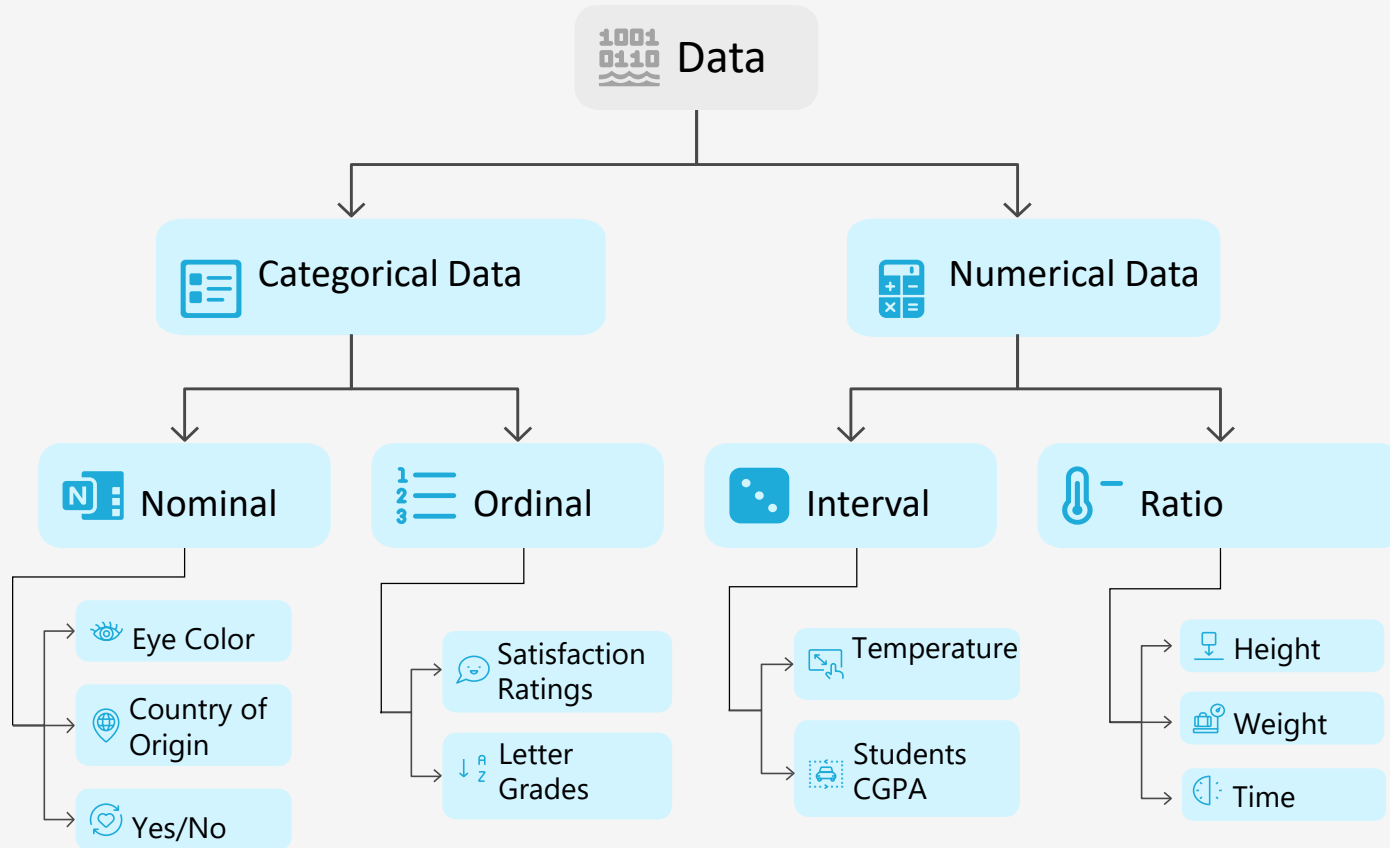
**Presenter: Nasim Reza**

June 22, 2025

# Key Questions Before Choosing a Test



# Types of Data



# Before You Run the Test: Data Exploration is Key!

*Proper exploration helps ensure your test selection is appropriate*



## Visualizing Data

Use histograms, box plots, and scatter plots to understand your data's distribution and relationships.



## Checking for Outliers

Identify and decide how to handle extreme values that may influence your results.



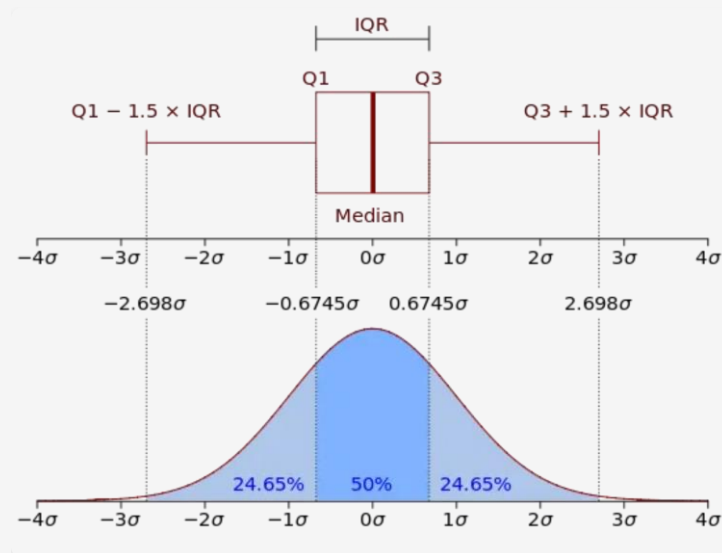
## Assessing Normality

Use Q-Q plots and Shapiro-Wilk test to check if your data follows a normal distribution.



## Assessing Homogeneity of Variances

Use Levene's test to check if different groups have similar variances.



**Visual inspection is often more informative than relying solely on statistical tests for assumptions!**

# What is Distribution?

A **distribution** is the pattern of variation in a dataset, showing how frequently different values occur and how they are spread out. It helps us understand the central tendency, variability, and shape of our data.



## Normal Distribution

Symmetrical, bell-shaped curve with most values clustering around the mean. Example: Heights in a population.



## Skewed Distribution

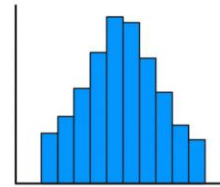
Asymmetrical with a longer tail on one side. Can be right-skewed or left-skewed. Example: Income distribution.



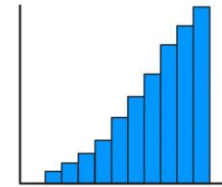
## Bimodal Distribution

Has two peaks, indicating two different clusters or subgroups in the data. Example: Exam scores from two different classes.

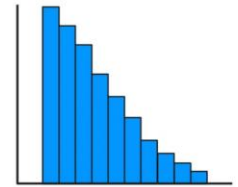
## Histogram Distributions



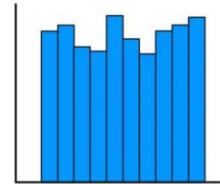
Normal distribution



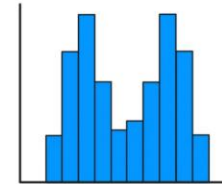
Left-skewed distribution



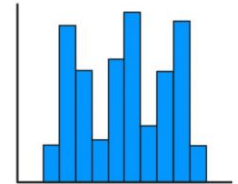
Right-skewed distribution



Uniform distribution



Bimodal distribution



Multimodal distribution

*The shape of your data's distribution helps determine which statistical tests are appropriate to use. Parametric tests typically assume a normal distribution.*

# Dependent vs Independent Observations

## Independent Observations

Observations or measurements that do not influence each other. Each data point is completely separate from other data points.

### Examples:

- Random samples from different populations
- Different participants in control vs. treatment groups



### *Independent events*

An events that are **not affected** by other events.

Two dice toss at the same time will have the same chance of outcome

## Dependent Observations

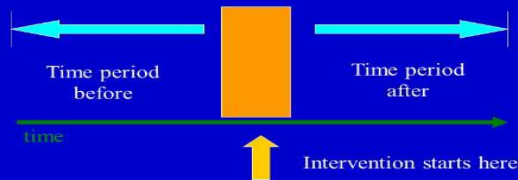
Observations or measurements that are related to or influenced by each other. Data points have a natural pairing or connection.

### Examples:

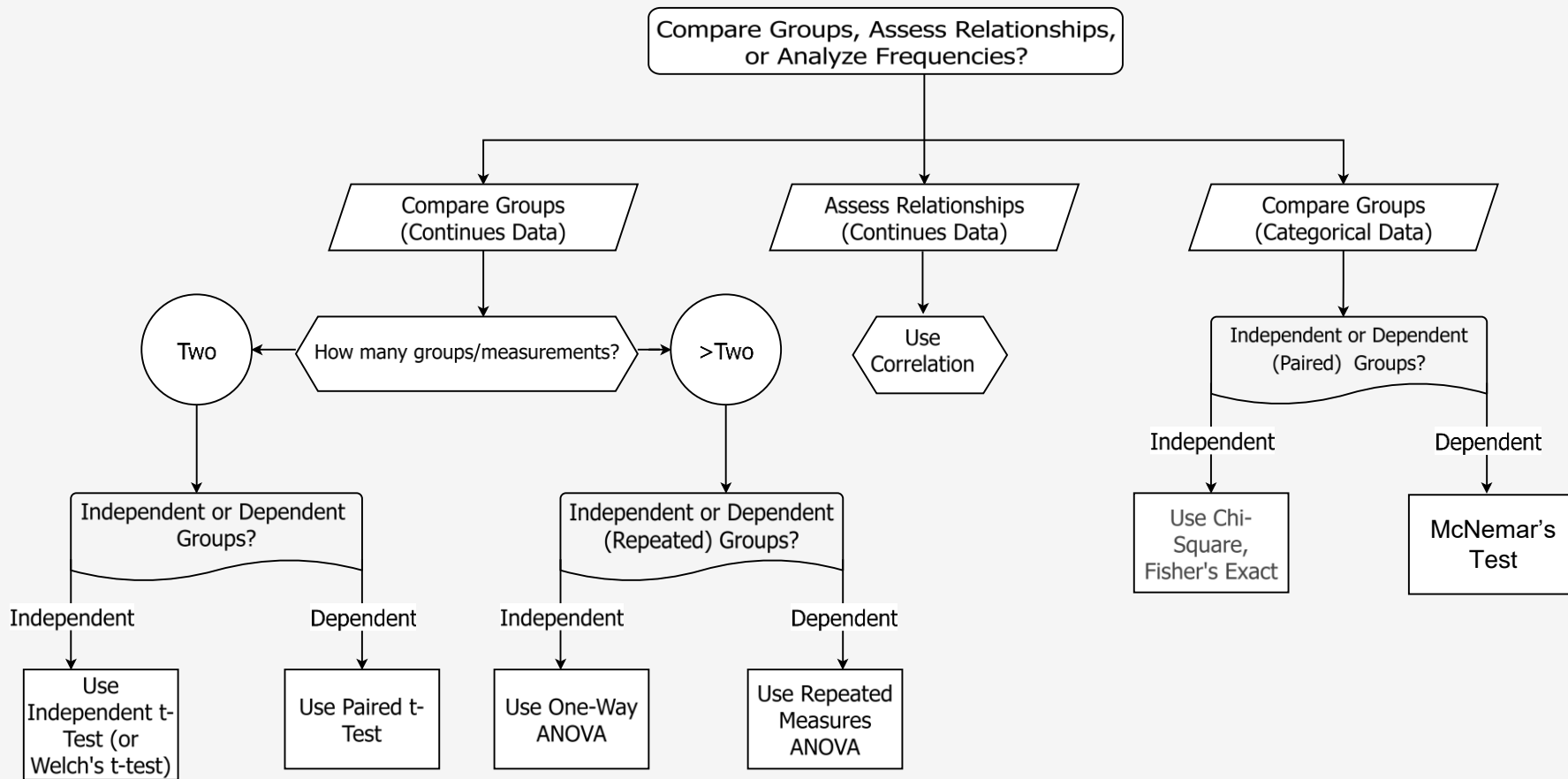
- Pre-test and post-test measurements on the same subjects
- Repeated measurements over time on the same subjects

## Before-and-After Studies

- A “quasi-experimental” design that surveys exposures and disease status before and after an intervention

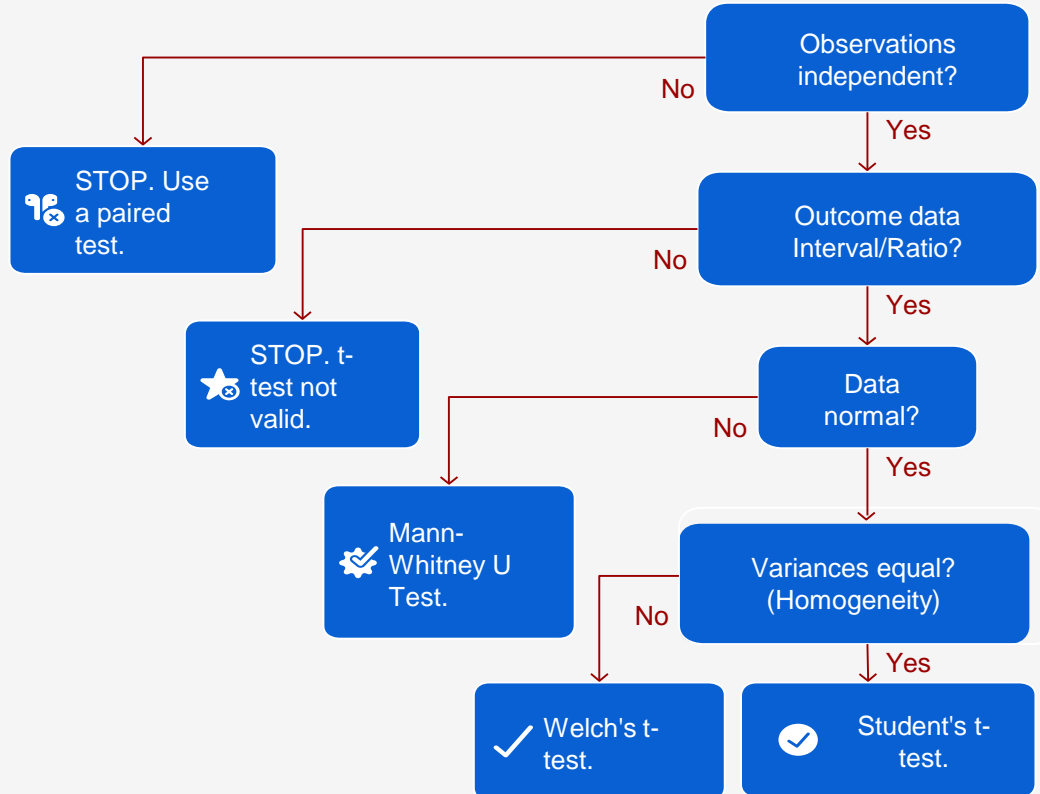


# Statistical Test Selection Flowchart



# Comparing Two Independent Groups

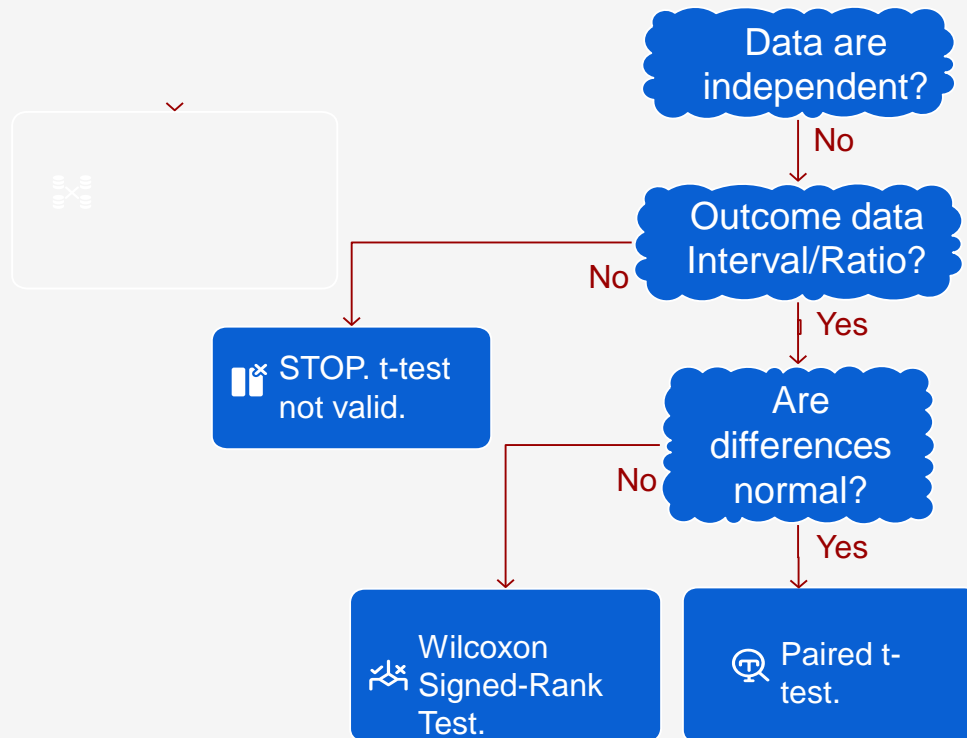
*Research Question: Is there a significant difference between two unrelated groups?*





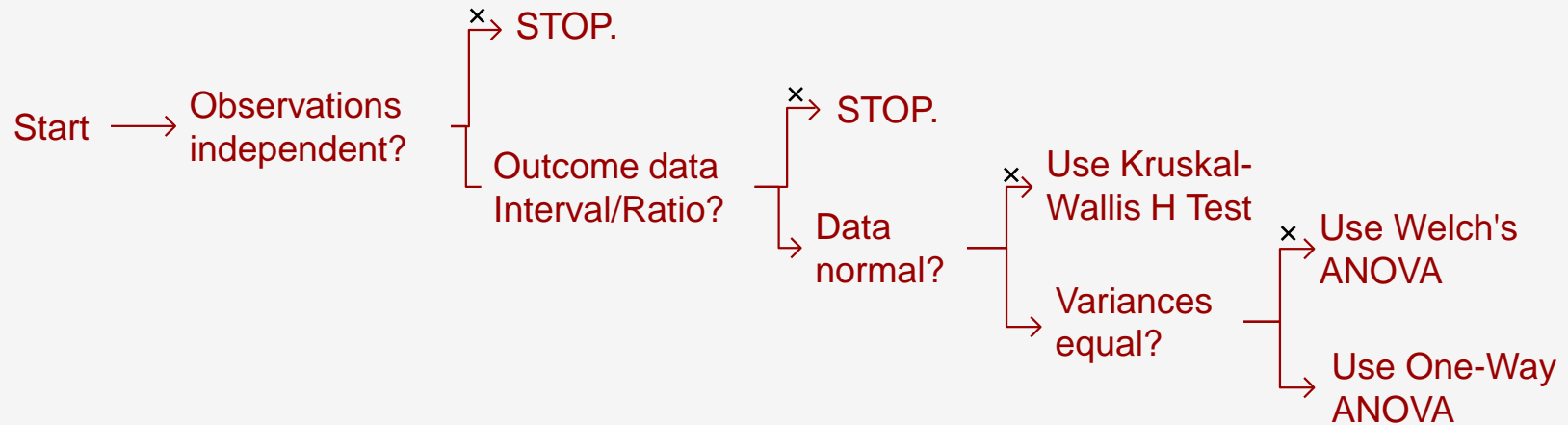
# Comparing Two Dependent (Paired) Groups

*Research Question: Is there a significant difference between two related measurements?*



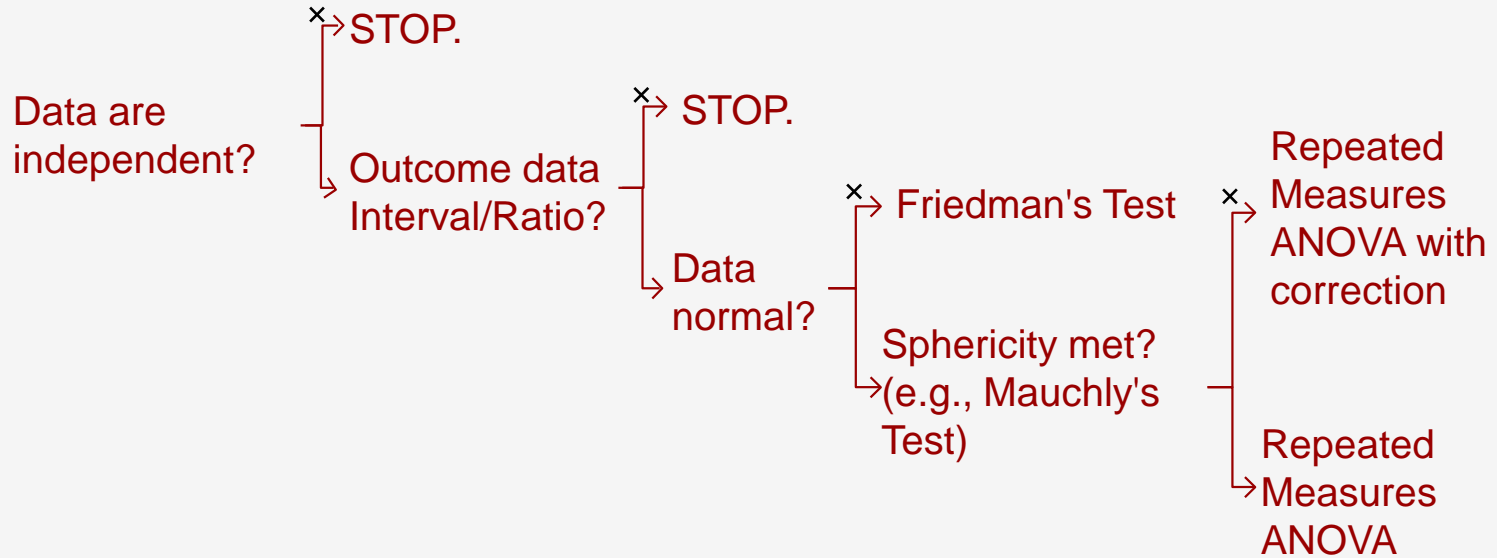
# Comparing Three or More Independent Groups

*Research Question: Is there a significant difference among three or more unrelated groups?*



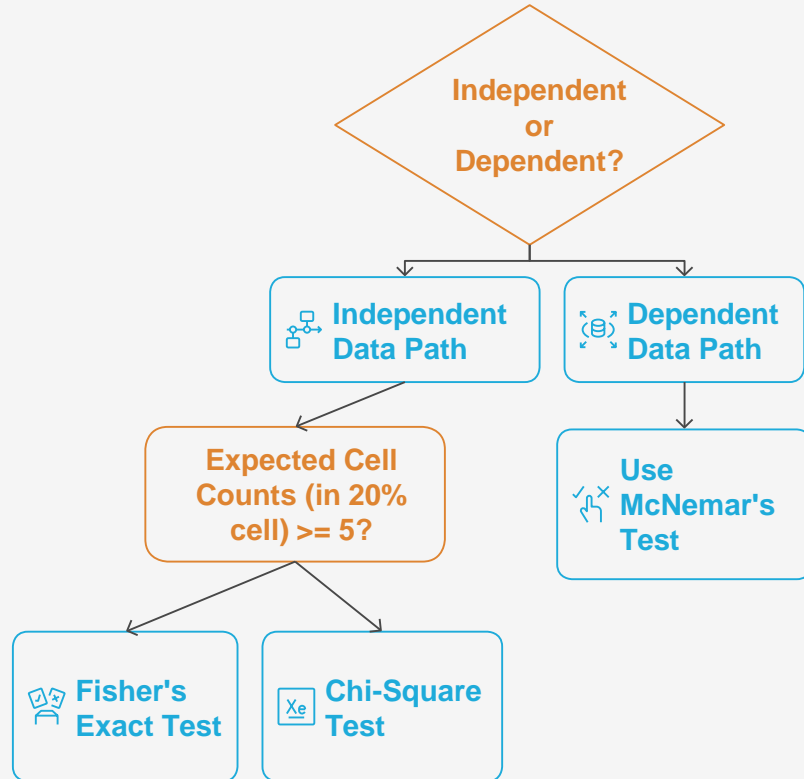
# Comparing Three or More Dependent Groups

*Research Question: Is there a significant difference across three or more related measurements?*



# Analyzing Categorical Data

*Research Question: Are observed frequencies/proportions different from expected, or is there an association between categorical variables?*



# A Checklist for Test Selection

Question	Your Response
<b>Research Question:</b>	<i>What are you trying to find out?</i>
<b>Number of Variables/Groups:</b>	<i>How many are involved?</i>
<b>Variable Type(s):</b>	<i>Nominal, Ordinal, Interval, Ratio?</i>
<b>Independence of Observations:</b>	<i>Paired or Independent?</i>
<b>Distribution:</b>	<i>Normal or non-normal?</i>
<b>Assumptions Met?</b>	<i>Yes/No</i>
<b>Chosen Test:</b>	<i>Based on above criteria</i>
<b>Alternative Test (if needed):</b>	<i>If assumptions not met</i>

# Thank You!

For taking the time to learn about selecting the right statistical test for your research needs.

Any Questions?

