**How to Select the Right Hypothesis Test**

Choosing the correct hypothesis test depends on **three main factors**:

1. **Type of Data** (Numerical or Categorical)
2. **Number of Groups Being Compared**
3. **Study Design and Assumptions**

**1. One Sample vs. Multiple Samples**

* **One sample**: Compare a single group to a known population.
* **Two samples**: Compare two independent or paired groups.
* **Multiple samples**: Compare more than two groups.

**3. Additional Considerations**

* **Parametric vs. Non-Parametric**:
  + If data is normally distributed → use **parametric tests**;
  + if not → use **non-parametric tests**.
* **Independent vs. Paired Data**:
  + If comparing the same subjects before/after an intervention → use **paired tests**;
  + if different groups (male / female) → use **independent tests**.
* **Sample Size**:
  + Small sample sizes may require exact tests like **Fisher’s Exact Test**
  + instead of **Chi-Square**.

**2. Choosing the Right Test Based on Data Type**

|  |  |  |  |
| --- | --- | --- | --- |
| Data Type | Comparing | Parametric Test (Normal Data) | Non-Parametric Test (Non-Normal Data) |
| Numerical (Continuous, Interval, Ratio) | One sample vs. population mean | **One-Sample t-test** | Wilcoxon Signed-Rank Test |
| Two independent groups | **Independent (Unpaired) t-test** | Mann-Whitney U Test |
| Two related groups (paired data) | **Paired t-test** | Wilcoxon Signed-Rank Test |
| More than two groups | **ANOVA** | Kruskal-Wallis Test |
| Categorical (Proportions, Counts) | One sample vs. expected proportion | **Chi-Square Goodness-of-Fit** | Binomial Test |
| Two independent groups | **Chi-Square Test of Independence** | Fisher’s Exact Test (if small sample) |
| Paired categorical data | **McNemar’s Test** | - |
| Relationship Between Two Variables | Both numerical | **Pearson Correlation** | Spearman Correlation |
| One numerical, one categorical | **t-test / ANOVA** | Mann-Whitney / Kruskal-Wallis |
| Both categorical | **Chi-Square Test** | Fisher’s Exact Test |

* **One-Sample t-test:**
* **Independent (Unpaired) t-test:**
* **Paired t-test:**
* **ANOVA:**
* **Chi-Square Goodness-of-Fit:**
* **Chi-Square Test of Independence:**
* **McNemar’s Test:**
* Wilcoxon Signed-Rank Test
* Mann-Whitney U Test
* Kruskal-Wallis Test
* Binomial Test
* Fisher’s Exact Test
* **Pearson Correlation:**
* **t-test:**
* **ANOVA:**
* **Chi-Square Test:**
* Spearman Correlation
* Mann-Whitney
* Kruskal-Wallis
* Fisher’s Exact

|  |  |  |
| --- | --- | --- |
| Test | Data Type | Used When |
| t-Test | **Numerical** | **Compare means** |
| Wilcoxon / Mann-Whitney | **Numerical** | **Non-parametric mean comparison** |
| ANOVA / Kruskal-Wallis | **Numerical** | **Compare multiple groups** |
| Chi-Square | **Categorical** | **Compare proportions** |
| Fisher’s Exact | **Categorical** | **Small sample proportions** |
| McNemar’s | **Categorical** | **Paired categorical data** |
| Pearson / Spearman | **Numerical** | **Relationship between two variables** |