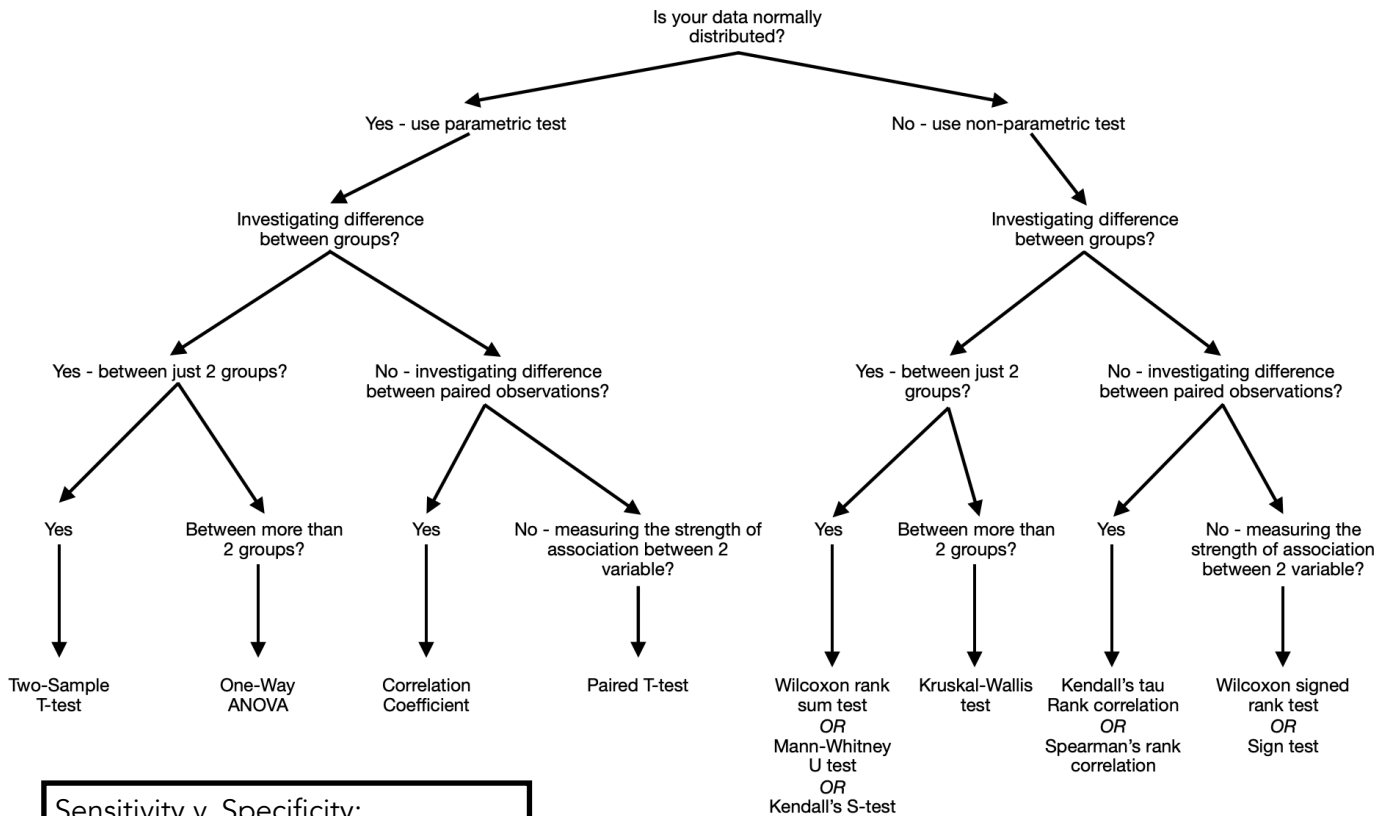


# Foundational Statistics Summary



**Sensitivity v. Specificity:**  
*Helps assess diagnostic methods*

**Sensitivity** is the number of true positives relative to all positives  
 ie. % of ppl *with the disease* that get a *positive* result

**Specificity** is the number of true negatives relative to all negatives  
 ie. % of ppl *without the disease* who get a *negative* result

**Likelihood Ratio** measures the chance of having a *true positive* rather than a *false positive* and vice versa with negatives)

**NNT:** Numbers needed to treat  
**NNH:** Numbers needed to harm

**Predictive Value** measures how likely an individual has the disease based on their diagnostic result  
 (unlike LR takes into account prevalence of disease!)  
 NPV and PPV (negative and positive predictive value)  
 ie. PPV chance one has disease if one has a positive result

Time, Years	Number at Risk (N <sub>t</sub> )	Number of Deaths (D <sub>t</sub> )	Number Censored (C <sub>t</sub> )	Survival Probability (S <sub>t</sub> )
...	...	...	...	...

**Life Tables** eg. Above (using the Kaplan-Meier/Product Limit Approach, can track survival over time.  
*Cumulative Survival Probability (S<sub>t</sub>):* is the proportion of participants remaining surviving (or remaining event-free) past interval<sub>t</sub>

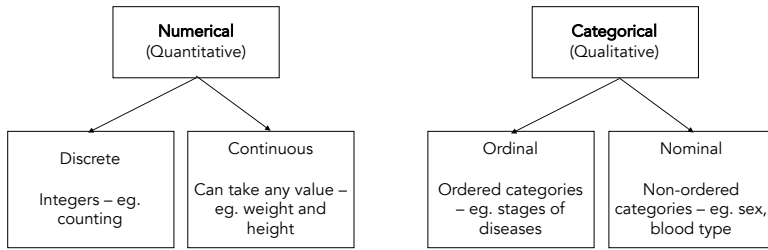
$$S_{t+1} = S_t * ((N_{t+1} - D_{t+1}) / N_{t+1})$$

This can be used to draw Kaplan-Meier curves!

Many options for statistical software:

- R
- SPSS
- Matlab
- GraphPad/Prism
- Excel etc.

## Foundational Statistics Summary



**Data Distribution:**  
 Normal? - Parametric tests  
 - Mean = Mode = Median  
 - 68% of AUC within 1 SD of mean  
 Standard Normal Distribution (SND)  
*If non-normal use non-parametric*

**Type I error:**  
 False positive  
  
**Type II error:**  
 False negative

**Null Hypothesis (H<sub>0</sub>):** that there is no significant difference.  
**P-value:** probability that the null hypothesis is true!  
 P-value threshold for significance **p<0.05**

**Degrees of freedom:**  
 - freedom to vary  
 - number of observations a statistic can vary by  
**Confidence Intervals:**  
 - helpful in denoting the range of values the means is expected to fall within (eg. 95% CI)  
 - CI can be found for various %'s

**Chi-Squared (X<sup>2</sup>)** aka. Pearson's Chi-squared:  
 - difference between two categorical groups  
 - Observed v. Expected! - DOF = no. poss. outcomes - 1

Analysis of Variance  
 ↓  
 ANOVA:

2 assumptions:  
 (1) independence  
 (2) normality

T-test: comparison of means  
 Three main types:  
 1. **Independent samples t-test** (aka. Unpaired t-test)  
     • Means for two independent groups  
 2. **Paired samples t-test**  
     • Means for same group at two time-points  
 3. **One sample t-test**  
     • Mean of one group against a known mean

ANOVA (also factorial and MANOVA)  
 - one way or two way (no. independent variables)  
 - ratio of variance within and between groups  
  
**One-Way ANOVA:** different treatment/conditions but measuring only one dependent variable  
  
**Two-Way ANOVA** (or **Factorial ANOVA** with 2 factors):  
 - three null hypothesis being tested  
     - Main effect of factor 1  
     - Main effect of factor 2  
     - Interaction effect of both (ie. does one rely on the other)  
  
 Nested/Hierarchical ANOVA: modelling data with hierarchies eg. Differences in pay by gender, then height, then weight

Correlation & Regression  
**Correlation** - figure b/t -1 and +1  
 - measured as a coefficient  
 - *how strongly an exposure variable is linked to an outcome*  
  
**Regression**  
 - expressed as an equation  
 - *how much one variable changes in relation to another*  
 - can be used for prediction!  
 - univariate to multivariate  
 - linear regression - y=mx + c basically  
 - logistic regression - for modelling *binary* outcomes; eg. disease state (case v control)

Risk Ratio aka. Relative Risk - proportion of two risks  
 Odds Ratio - ratio of odds of two outcomes  
 Hazard Ratio - impact of an exposure on an outcome over time

Continue to the next page :)