Errors

- Type I error: H_0 is true but the study rejects it. So, assuming two groups there is no differences between the groups but a statistically significant difference is found. α gives the probability of a type I error.
- Type II error: H_0 is false but the study fails to reject it. So, the the two groups are different but the study does not find a difference. β gives the probability of a type II error.
- $power = 1 - \beta$.

Low powered studies

- Research pays careful attention to type I errors. That is we do not want to find an effect when one does not exist. This is typically, true in bio-medical applications. We don't want to put treatments in the public domain that do not work.
- However, many studies do not pay enough attention to power. If studies have low power then they have high probability of not rejecting a false H_0 This has the consequence of not finding differences in treatments, usually small effects, that are actually statistically significant.
- Power is affected by: a) Precision and variance of measurements in a sample (e.g. 95% CI) b) The size of the effect. If effect size is small very precise and accurate estimates of the true population values are needed c) How much we want to avoid a type I error (lower α lower power)d) the type of statistical test (parametric vs non-parametric).

Relation between α and power

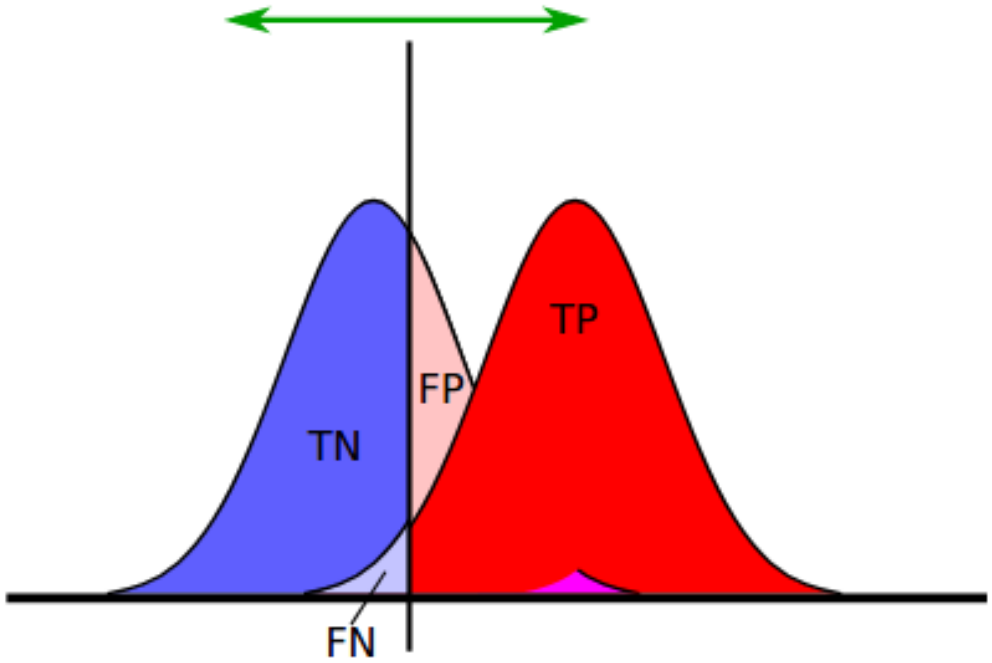

Figure: Antibody level on vaccine administration. The left distribution is for not injected subjects the right for those injected. Varying the threshold changes TP, FP, TN, FN. (Image from Wikipedia.)

Low α (reducing FP) leads to low power (increasing FN).