Statistics approaches

- Bayesian statistics (prior belief)

$$P(A \mid B) = \frac{P(B \mid A)\ P(A)}{P(B)}$$

- Frequentist statistics (default action)

- Considering A as the control group and B as the test group, null hypothesis considers 'there's no difference between groups A & B'. Accepting null hypothesis is to continue with default action meaning, not changing the mind and for this p-value must be large enough that is higher than the threshold or significance level (100%- CL%).
- The alternative hypothesis says, 'there's a difference between the groups which is the effect of an experiment/test'. Thus, accepting alternative hypothesis would be changing mind or leaving default action.

✓ *rejecting null hypothesis → alternative action, lower p-value (below significance level often set to 5% or 0.05)*

✓ *accepting null hypothesis → default action, higher p-value (above significance level often set to 5% or 0.05)*

- *Type I error: Changing mind when should not (FP) ex. Convicting an innocent person*
- *Type II error: NOT changing mind when should (FN) ex. Not convicting a guilty person*

Higher the power, lower is p(FN)

[p(FN) = 1 - p(TP)]

		Predicted Class: Positive	Predicted Class: Negative	
Actual Class	**Positive**	True Positive (TP)	False Negative (FN) **Type II Error**	**Sensitivity** $\frac{TP}{(TP+FN)}$
Actual Class	**Negative**	False Positive (FP) **Type I Error**	True Negative (TN)	**Specificity** $\frac{TN}{(TN+FP)}$
		Precision $\frac{TP}{(TP+FP)}$	**Negative Predictive Value** $\frac{TN}{(TN+FN)}$	**Accuracy** $\frac{TP+TN}{(TP+TN+FP+FN)}$

The probability of making a Type I error (wrong rejecting the null) is α

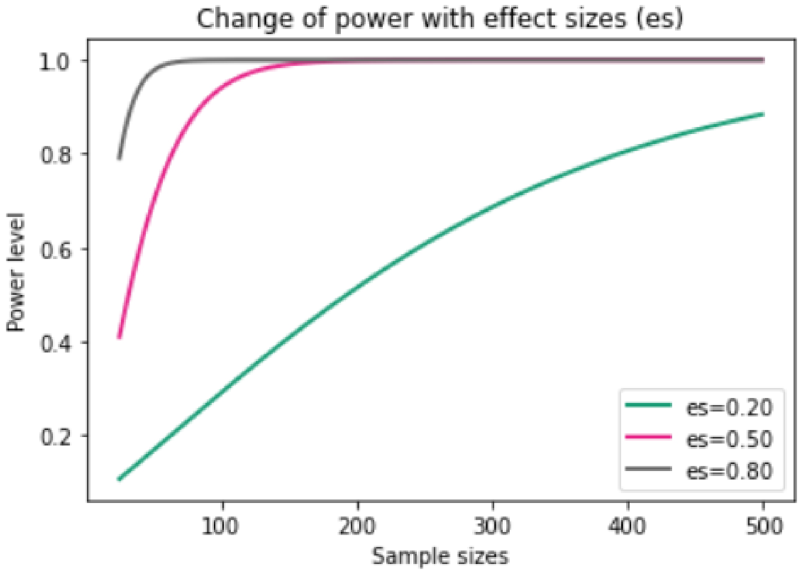
→ Statistical Power (power of test)

The probability of making a Type II error (wrong accepting the null) is β.

How can we obtain the sample size that makes sure the statistical power of our test is adequate?

- Sample size – to be estimated
- Significance level (0.05)
- Effect size (0.8) → max standard empirically found
- Power level (0.8) – probability of accepting alternative hypothesis

How many observations are required from each sample to at least detect an effect of 0.80 with 80% chance of detecting a Type I error?



With increasing sample size, there’s a leap in the power.

Significance & Confidence levels

- To accept null hypothesis, p-value must be large enough (> significance level α) meaning there's no effect 95 out of 100 times.

$$\alpha = 100\% - \text{Confidence level } (95\%)$$

Computation of p-values requires performing tests:

If test statistic > critical value, reject null hypothesis.

[If p-value < α, reject null hypothesis]