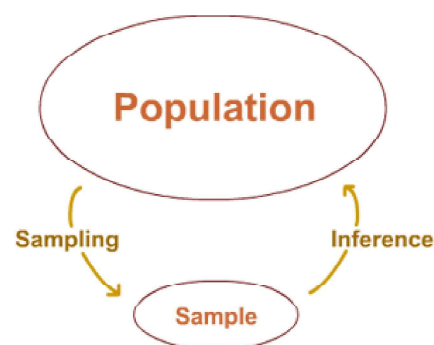


Variability and inferential statistics

Inferential statistics

- Drawing inferences from samples about populations
- Effects in sample \neq effects in population
- Statistic - measures that refer to sample
- Parameter - measures that refer to entire pop.
(Greek letters)



Distributions

Raw score distribution

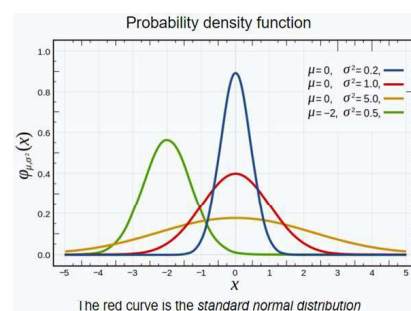
- A distribution of raw scores is based on a real set of data
- Mean = M
- ⇒ Shows variability across individuals

Sampling distribution

- A distribution of the means obtained by repeating a study with new samples
- Samples must be of the same size
- The sample mean would vary between samples
- x-axis - sample mean value (M)
- y-axis - frequency of M
- Sample mean will be distributed about the pop. mean in some way → most of the time (regardless of distribution of raw scores) the sample mean will have a distribution that is approx. normal
- Mean of $M = \mu$ → population mean = μ - middle of the graph
- Standard error - measure of spread of sample means i.e. standard deviation of population data
- In practice, only 1 sample is typically used
- ⇒ Shows variability across experiments
- ⇒ Shows likelihood of obtaining a result if the null hypothesis is true

Normal distribution

- Symmetrical
- Unimodal
- Have a particular spread of scores
 - $\frac{2}{3}$ of all scores fall within 1 SD of the mean
 - 68, 95, 99.7% rule



P-values

- The probability that we obtained our sample mean when the null hypothesis is true i.e. nothing in the pop. is happening
 - The bigger the number, the less likely the sample mean was sampled from a population where nothing was happening
 - Small p-value → improbable result was obtained by chance alone
 - Large p-value → probable result was obtained by chance alone
 - Low p-value is desirable → suggests null hypothesis is false
 - A probability - $0 < p < 1$
 - $p < 0.05$ → “statistically significant” → reject null hypothesis
 - $p > 0.05$ → “did not reach statistical significance” → retain null hypothesis
 - Calculated based on assumptions about the sampling distribution and its normal shape
- ⇒ Indicates the reliability of an effect, unrelated to how large effect is

Practical significance and statistical power**Science is probabilistic**

- **Liberal** decision rule (open-minded) - reject null if $p < 0.2$
- **Normal** decision rule - reject null if $p < 0.05$
- **Conservative** decision rule (closed-minded) - reject null if $p < 0.0001$

Types of error - as one type of error ↑, the other ↓

Type 1 - α

- The probability of rejecting the null if it is true
- Value of α = significance level of the test

Type 2 - β

- The probability of retaining (failing to reject) the null if it is false
- Value of β depends on a number of factors
 - Choice of α
 - True value of parameter
 - Sample size
 - Variability of the effect you are looking for
 - Alternative hypothesis