# Sample Size Determination

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# Outlines

- Estimation – One Mean/Percentage
- Hypothesis testing – Comparing Two Means (Independent/Paired)/Percentages

# Software used

- Sample Size Calculator (web)

  https://wnarifin.github.io/ssc_web.html

# Estimation

## 1. One mean

- Estimate mean of numerical variable in population e.g. blood pressure, BMI etc.

# Estimation

- Conduct a study to estimate mean systolic blood pressure (SBP) among USM medical students. How many medical students should you measure? All of them?
- Sample! Need to calculate minimum number of students to measure → get precise estimation.

# Estimation

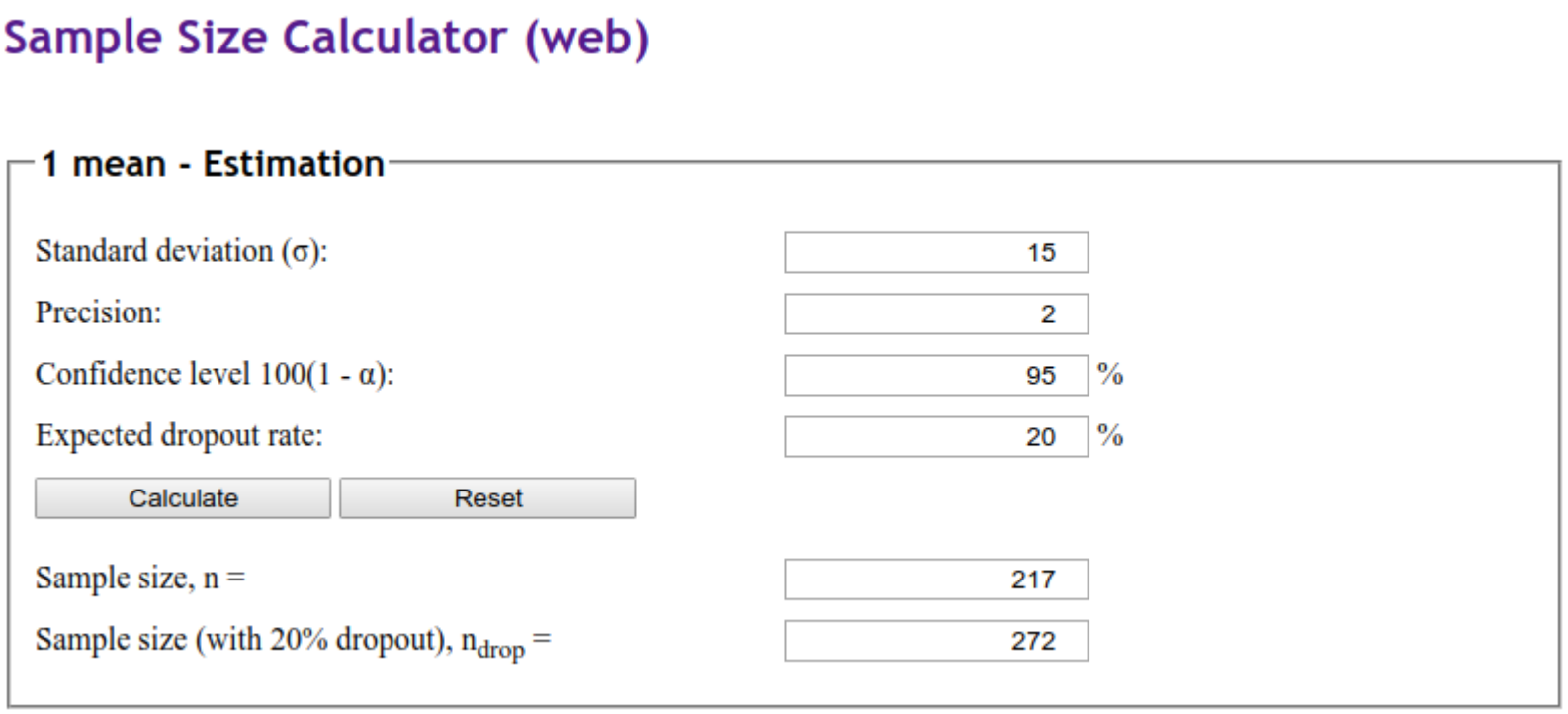
- What you need:
  - Standard deviation of SBP from other studies.
  - Set your precision (in unit of measurement, e.g. 1mmHg, 2mmHg, …).
  - Set Confidence level (90%, **95%**, 99%).
  - Dropout % – % of your participants that run away from study.

# Estimation

- Let say:
  - SD of SBP = 15mmHg.
  - Precision = 2mmHg
  - 95% Confidence level
  - 20% dropout

# Estimation

- Means → Single Mean → 1 mean – Estimation



# Estimation

- You have to sample 272 medical students to estimate mean SBP among USM medical students, with mean SBP ± 2mmHg.

# Estimation

## 2. One percentage/proportion

- Estimate % of of categorical variable in population e.g. obesity status, HIV, diabetes etc.

# Estimation

- Conduct a study to estimate % of obesity among USM medical students. How many medical students should you sample?

# Estimation

- What you need:
  - % of obesity among medical students from other studies.
  - Set your precision (in percentage, 1%, 2%, 5%...)
  - Set Confidence level (90%, **95%**, 99%).
  - Dropout % – % of your participants that run away from study.

# Estimation

- Let say:
  - % of obesity = 25% = 0.25 (in proportion).
  - Precision = ±5% = 0.05 (in proportion).
  - 95% Confidence level.
  - 10% dropout (i.e. those who won't let you know their BMI).

# Estimation

- Proportions → Single proportion → 1 proportion – Estimation

**Sample Size Calculator (web)**

**1 proportion - Estimation**

| | | |
|---|---|---|
| Proportion (p): | 0.25 | |
| Precision: | 0.05 | |
| Confidence level 100(1 - α): | 95 | % |
| Expected dropout rate: | 10 | % |

Calculate Reset

| | |
|---|---|
| Sample size, n = | 289 |
| Sample size (with 10% dropout), $n_{drop}$ = | 322 |

# Estimation

- You have to sample 322 medical students to estimate % of obesity among USM medical students, with % obesity ± 5%.

# Hypothesis Testing

## 3. Comparing two means of two populations

- Testing hypothesis that means of a continuous variable for two different populations are actually different → Using independent t-test.

# Hypothesis Testing

- Conduct a study to compare mean BMI of Year 5 with Year 2 medical students. How many medical students should you sample from each population?

# Hypothesis Testing

- What you need:
  - SD of BMI of medical students from other studies (preferably Year 5/Year 2, take the largest you could find).
  - Set Expected difference in BMI between the two populations.
  - Determine Significance level = **0.05**, 0.01, 0.001.
  - Power of the test – usually 80%.
  - Dropout %.

# Hypothesis Testing

- Let say:
  - Largest SD you could find from literature = 1.5
  - Expected Difference = 1 unit.
  - Significance level = 5% (0.05)
  - Leave Power = 80% – default value.
  - 30% dropout (i.e. as some weight themselves while only one foot was on the scale...).

# Hypothesis Testing

- Means → Two-mean comparison (independent) → 2 means – Hypothesis Testing

**Sample Size Calculator (web)**

**2 means - Hypothesis Testing**

| | | |
|---|---|---|
| Standard deviation (σ): | 1.5 | |
| Expected difference: | 1 | |
| Significance level (α): | 0.05 | Two-tailed |
| Power (1 - β): | 80 | % |
| Expected dropout rate: | 30 | % |

Calculate Reset

| | |
|---|---|
| Sample size, n = | 36 |
| Sample size (with 30% dropout), $n_{drop}$ = | 52 |

# Hypothesis Testing

- You have to sample 52 Year 5 students and 52 Year 2 students to make the comparison, expecting a difference of 1 unit BMI between the two.

# Hypothesis Testing

## 4. Comparing percentages of two populations

- Testing hypothesis that percentages of a categorical variable for two different populations are actually different → Using Chi-squared test.

# Hypothesis Testing

- Conduct a study to compare % of obesity among Year 2 with Year 5 medical students. How many medical students should you sample from each population?

# Hypothesis Testing

- What you need:
  - % of obesity of Year 2 medical students (as control, $p_0$) from other studies (or Year 5 as control, you decide).
  - Set expected % of obesity of Year 5 students (as case, $p_1$).
  - Determine Significance level = **0.05**, 0.01, 0.001
  - Power of the test – usually 80%.
  - Dropout %.

# Hypothesis Testing

- Let say:
  - $p_0$ = 35% = 0.35 (in proportion) → Year 2/medical students in general as control.
  - $p_1$ = 50% = 0.5 (in proportion) → If you think this could be the % for Year 5 students.
  - Significance level = 5% (0.05)
  - Power = 80% (0.8)
  - 10% dropout.

# Hypothesis Testing

- Proportions → Two-proportion comparison (independent) → 2 proportions – Hypothesis Testing

**Sample Size Calculator (web)**

**2 proportions - Hypothesis Testing**

| | | |
|---|---|---|
| Proportion in control ($p_0$): | .35 | |
| Proportion in case ($p_1$): | .5 | |
| Significance level ($\alpha$): | 0.05 | Two-tailed |
| Power ($1 - \beta$): | 80 | % |
| Expected dropout rate: | 10 | % |

Calculate Reset

| | |
|---|---|
| Sample size, n = | 170 |
| Sample size (with 10% dropout), $n_{drop}$ = | 189 |

# Hypothesis Testing

- You have to sample 189 Year 2 students and 189 Year 5 students to make the comparison, expecting a difference of 15% for % of obesity between the two.

# References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