Designing a Research project

Dr Hadeel Mohammed Abbood

- The first step in designing a research is identifying a **Research Question (RQ)**
- **What is a research question?**
  - It is a specific inquiry in scientific fields that needs a special design of research to find an answer to.
  - It represents the keystone of any research project.
  - A good research question can identify a study design and research method.

- To develop a RQ,
  1. Identifying the subject of interest
  2. Do preliminary search on that subject.
  3. Narrow the focus and scope of the research subject,
  4. Frame a RQ and then evaluate it.

A good research question:

- Feasible: It is within the ability of the investigator to carry out.
- Interesting: This interest will motivate one to keep going with RQ.
- Novel: It may aim at confirming or refusing the already established findings, establish new facts, or find new aspects of the established facts.
- Ethical: It should guide in avoiding deceptive practices in research.
- Relevant: The question should be of academic and intellectual interest to people in the field.
- Appropriate: RQ should be appropriate logically and scientifically for the community and institution.
- Potential value and publishability: The study can make significant health impact in clinical and community practices.

Steps of doing a research project

- Read previous literature
- Reject or accept the hypothesis

Aim or research question

- The aim is an explanation for a research question.
- When you set a research question, you need to identify an exact goal/s. So, when you achieve them you can say that you answered the question

Example

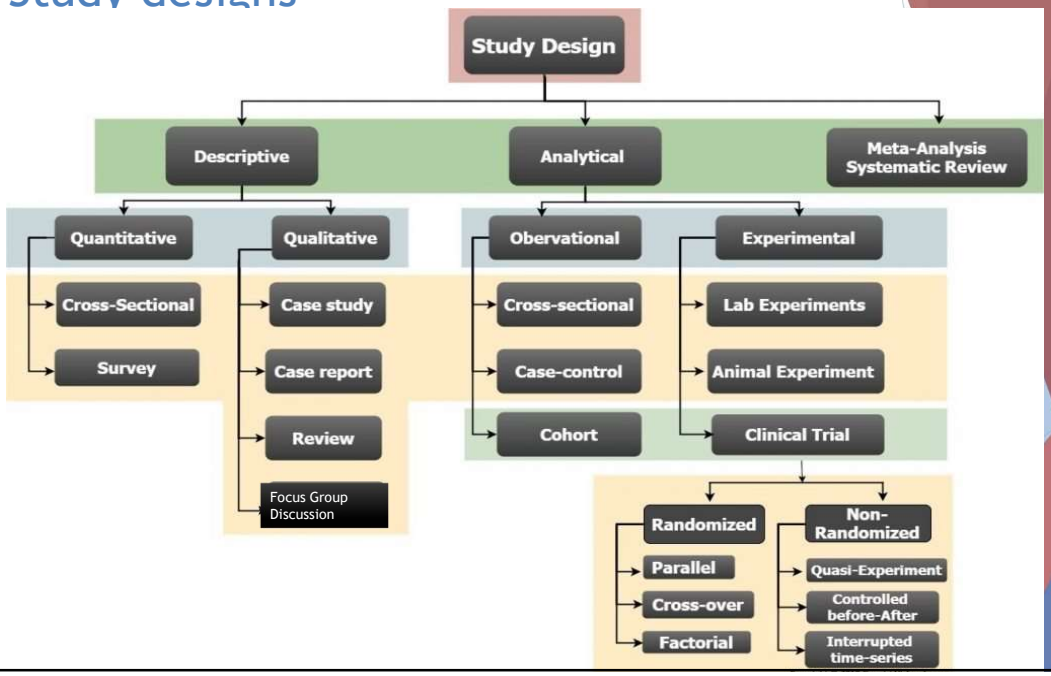
- Title: The effectiveness of CHX and essential oils on gingivitis and dental caries
- RQ: is there a difference between the effectiveness of CHX and essential oils on gingival inflammation and dental caries?
- Aims: Compare the effectiveness of essential oil and chlorhexidine containing mouth rinses on dental plaque and gingivitis, a second aim is to compare their relative efficacy in patients with and without dental caries.

Develop a Hypothesis

- A hypothysis is a predicted answer to the research question
- It is agreeable to set a null answer to the RQ
- Researchers use a null hypothesis to test whether their research hypothesis is supported by the data or not
- A null hypothesis is a statement that there is no effect or relationship between variables in the population being studied

- A null hypothesis is tested when the probability of the results are “due to chance alone” but the data collected reasonably suggest that something (a factor, a reason or other variable) in the studied environment/population leads to a difference/relationship/pattern between them.
- When the result is because of “something other than chance”, the null hypothesis is rejected and the alternative hypothesis comes to play because the data, indirectly, led us to support it

Study designs



Cross-sectional

- A cross-sectional study is a type of research design in which you collect data from many different individuals at a single point in time. In cross-sectional research, you observe variables without influencing them.
- Cheaper
- Less time-consuming
- Allow you for easily collect data that can be used as a basis for further research.

- Cross-sectional studies can be used for both analytical and descriptive purposes:
  - An analytical study tries to answer how or why a certain outcome might occur.
  - A descriptive study only summarizes outcome using descriptive statistics.
- Descriptive *vs.* analytical example
  - You are studying child obesity.
    - A descriptive study might look at the prevalence of obesity in children,
    - Analytical study might examine exercise and food habits in addition to obesity levels to explain why some children are much more likely to be obese than others

Case-control study

- Identifying risk factors
- Studying possible causative factors
- Identifying associations and relationships
- Example

> Oral Surg Oral Med Oral Pathol Oral Radiol. 2019 Nov;128(5):498-507.e3.
doi: 10.1016/j.oooo.2019.07.005. Epub 2019 Jul 15.

A case–control study of dental abnormalities and dental maturity in childhood cancer survivors

Reyna Aguilar Quispe [1], Ana Carolina Cunha Rodrigues [2], Ana Maria Greff Buaes [3], Ana Lucia Alvares Capelozza [4], Cássia Maria Fischer Rubira [4], Paulo Sérgio da Silva Santos [4]

Affiliations + expand

PMID: 31409543 DOI: 10.1016/j.oooo.2019.07.005

Abstract

Objective: The aim of this study was to evaluate dental abnormalities and dental maturity (DM) in the permanent dentition of childhood cancer survivors (CCSs) in comparison with that of healthy individuals.

Example: Smoking and Periodontitis

	Cases (Periodontitis) 100	Controls (Healthy perio) 100
Exposure (Smokers)		
No exposure (Non smokers)		

Cohort study

Prospective

- Common diseases
- Identify a population and follow them for a long period of time

Retrospective

- Can be used for rare diseases
- Identify a population and look back in their records

> Cancer Causes Control. 2013 Oct;24(10):1811-20. doi: 10.1007/s10552-013-0259-0. Epub 2013 Jul 12.

Marijuana use and risk of lung cancer: a 40-year cohort study

Russell C Callaghan [1], Peter Allebeck, Anna Sidorchuk

> J Neurosurg Anesthesiol. 2009 Oct;21(4):286-91. doi: 10.1097/ANA.0b013e3181a71f11.

A retrospective cohort study of the association of anesthesia and hernia repair surgery with behavioral and developmental disorders in young children

Charles DiMaggio [1], Lena S Sun, Athina Kakavouli, Mary W Byrne, Guohua Li

Start of the study
Now

Disease???

Exposure

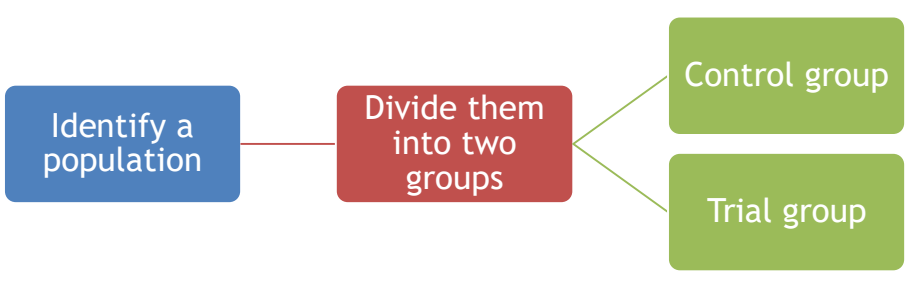
Start of the study
Now

Exposure???

Disease

Clinical trials

- Randomized
- Non-randomized
- Studying the effect of a treatment (procedure, medicine…etc).
- Placebo: a medicine or procedure prescribed for the psychological benefit to the patient rather than for any physiological effect.It can also used as a control to test new drugs.



How can we choose the right study design

- Set a RQ
- Identify a population
- Assess the time you have
- Assess the resources

Thank you

Writing a research protocol

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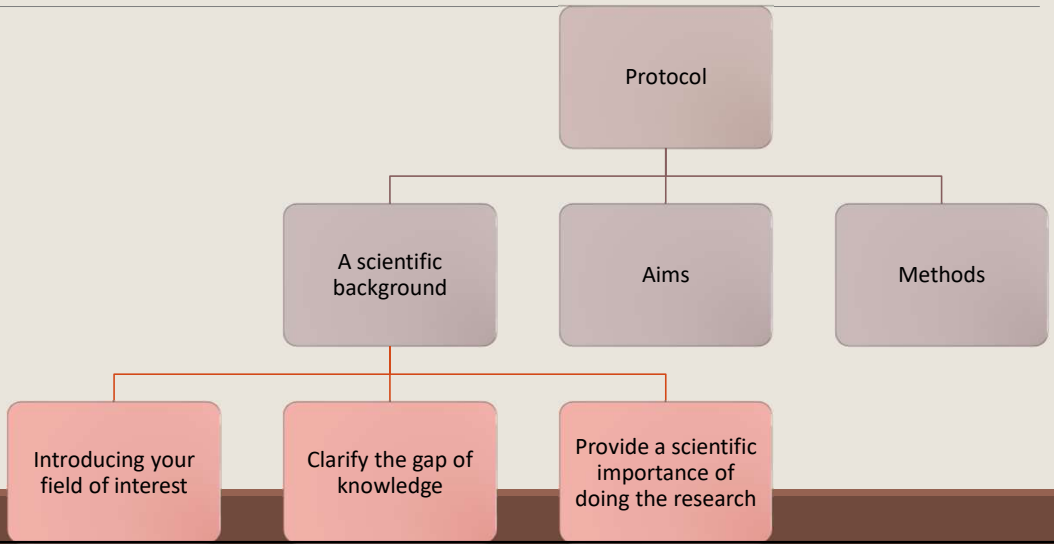
What is a research protocol

It is a document provides a scientific background, justification and a research plan

Simply it is the introduction and the methods section of your future manuscript.

How can we plan a protocol



Writing a protocol means you finished 30% of your final thesis

A protocol is simply represent the introduction and the methods of your final thesis

The difference will be in methods

- Using future tense in protocol

أساسيات الكتابة

الإلتزام بقواعد اللغة

التنقيط والتشكيل الصحيح

Avoid plagiarism

DO NOT COPY AND PASTE

USE YOUR WON WAY OF WRITING

individuals. Some studies suggest that obese individuals develop infections of various types (including postoperative and nosocomial infections) more often than do people of normal weight (77). The mecha-

HOW DO YOU WRITE IT WITHOUT PLAGIARISM

Studies have shown that obese patients are more prone to different types of infections than normal weight people, such as nosocomial and postoperative infections (Ref).

Simple language and easy to read

WHICH PARAGRAPH IS EASY TO READ?

Studying the distribution of a disease in a population and its determinants is called epidemiology. Looking at the community in general and its characteristics is the focus of the epidemiologist

Epidemiology is the science of studying the distribution of the disease and its determinants in the population. Epidemiologists mainly focus on the general characteristic of the community.

Write it as a story

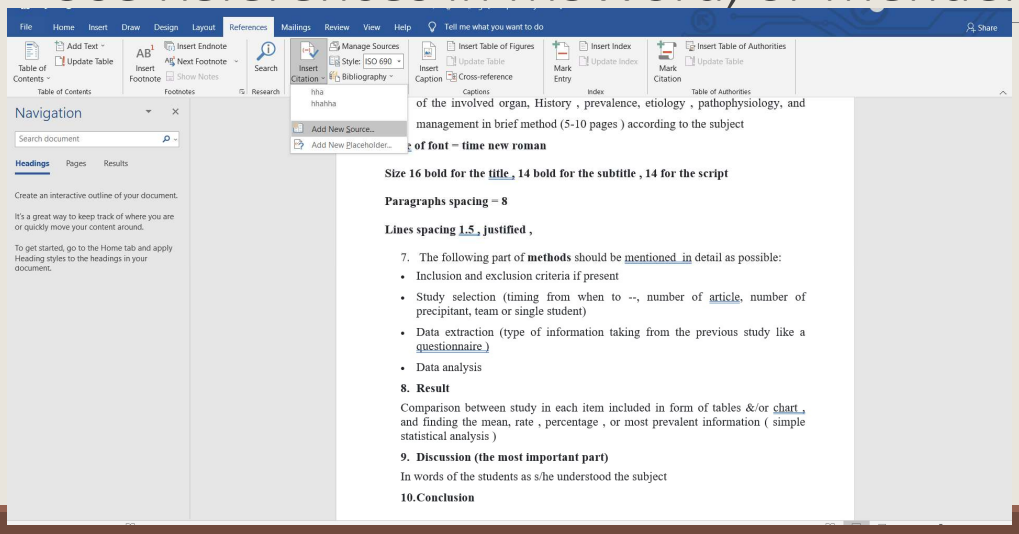
- Paragraph has more than one sentence.
- Each paragraph should have one idea.
- The sentences are connected in a flow

The cause of metabolic syndrome, although not completely known, appears to be associated with insulin resistance. Risk factors for metabolic syndrome include age, race, obesity, a history of diabetes and other diseases, including hypertension, cardiovascular disease and polycystic ovary syndrome.

Metabolic syndrome itself is an important risk factor for type 2 diabetes and cardiovascular disease, and it increases total mortality (93). Other complications include kidney disease, nonalcoholic fatty liver disease, peripheral artery disease, and stroke (9, 229).

There is recent concern on whether metabolic syndrome, as a whole, predicts clinical outcomes, such as atheromatous disease or type 2 diabetes, more than is predicted by the effects of its components (9, 254).

Cite each paragraph
Use References in MSWord, or Mendeley



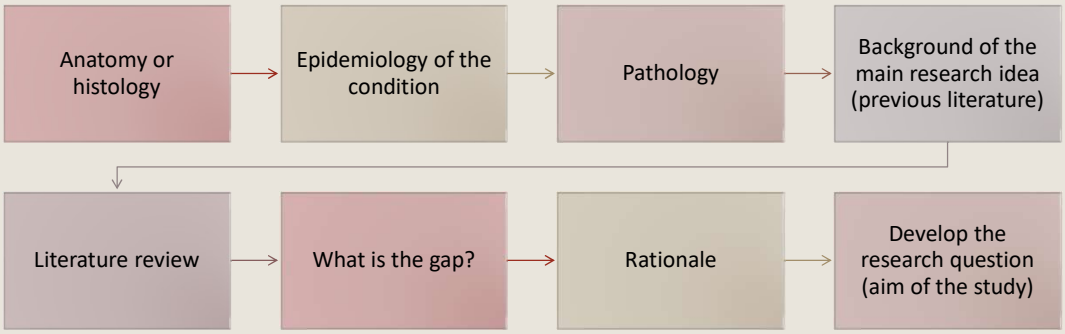
Each abbreviation most be declared in first time mentioned

PDL, IL-6, PGE2…etc

EX: Interleukin (IL)-6 is a proinflammatory cytokine…….

……. In periodontitis, bone resorption can occur as a result of high levels of IL-6.

Introduction



Literature review

- Critically evaluate the existing papers on the research area.
- Compare the findings of these papers.
- Evaluate the methods used in the previous studies to achieve the aim.
- Identify the limitations in previous studies.
- Detailed literature review/discussion should be reserved for the discussion section.

writing the methods

The following part of methods should be mentioned in details as possible:

Study design

Clinical studies:

- Recruiting participants (methods, place, age, ethnisity…etc).

Inclusion and exclusion criteria if present

Data extraction (type of information taking, like a questionnaire, clinical diagnosis, laboratory procedure

- For reviews: mention the search engines used ,the terms used for searching, and time of last electronic search)

Data analysis (type of analysis: significance level, RR, OR, t-test…etc) and the program name used for analysis.

Materials

يذكر بالتفصيل كل المواد المستعملة بما في ذلك الأدوات الطبية والشركة المصنعة لها

يفضل وضع صور توضيحية للأجهزة المستعملة

ذكر نوع الجهاز المستعمل والجهة المصنعة وسنة الإصدار

If you are using an index explain this index the origin, definition and the scale

Example:

- GI = Loe and Silness 1964, 0=no signs of gingivitis, 1= visible changes in color shape, 2= bleeding on probing, 3= spontaneous bleeding

Thank you

Suggestion

Write the introduction and the methods and send it to your supervisor

Statistics

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Results

- It is the section of our scientific paper that we show in it our findings.
- Written with visual aids (Tables, graphs…etc.)

Collecting data (row data)

	A	B	C	D	E	F	G	H	I	J	K
1	طابع زمني	عنوان البريد الإلكتروني	الجنس؟	العمر؟	الرجاء اختيار المرحلة الدراسي	هل كان الإمتحان السابق وزار	1-حوية في الإسترخاء والراحة	2-شعرت بجفاف في حلقي	3- شاعر إيجابية على الأطلاق	4. ن بدون القيام مجهود بدني)	5. ادرة بعمل الأشياء
2	6/19/2022 15:53:06	[redacted]	أنثى	23	المرحلة الخامسة	نعم	3	2	3	2	
3	6/19/2022 15:55:58	[redacted]	أنثى	24	المرحلة الخامسة	نعم	3	2	1	0	
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5	6/19/2022 16:12:50	[redacted]	أنثى	23	المرحلة الخامسة	نعم	3	3	3	1	
6	6/19/2022 16:16:55	[redacted]	ذكر	23	المرحلة الخامسة	نعم	1	2	2	2	
7	6/19/2022 16:24:28	[redacted]	ذكر	25 أو أكثر	المرحلة الخامسة	نعم	0	0	0	0	
8	6/19/2022 16:44:55	[redacted]	أنثى	24	المرحلة الخامسة	نعم	3	3	3	3	
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0	6/19/2022 17:04:43	[redacted]	أنثى	23	المرحلة الخامسة	نعم	3	3	2	2	
1	6/19/2022 17:08:18	[redacted]	أنثى	24	المرحلة الخامسة	لا	2	2	3	0	
2	6/19/2022 17:22:54	[redacted]	ذكر	24	المرحلة الخامسة	نعم	1	2	2	3	
3	6/19/2022 18:05:06	[redacted]	ذكر	22	المرحلة الخامسة	نعم	0	0	0	0	
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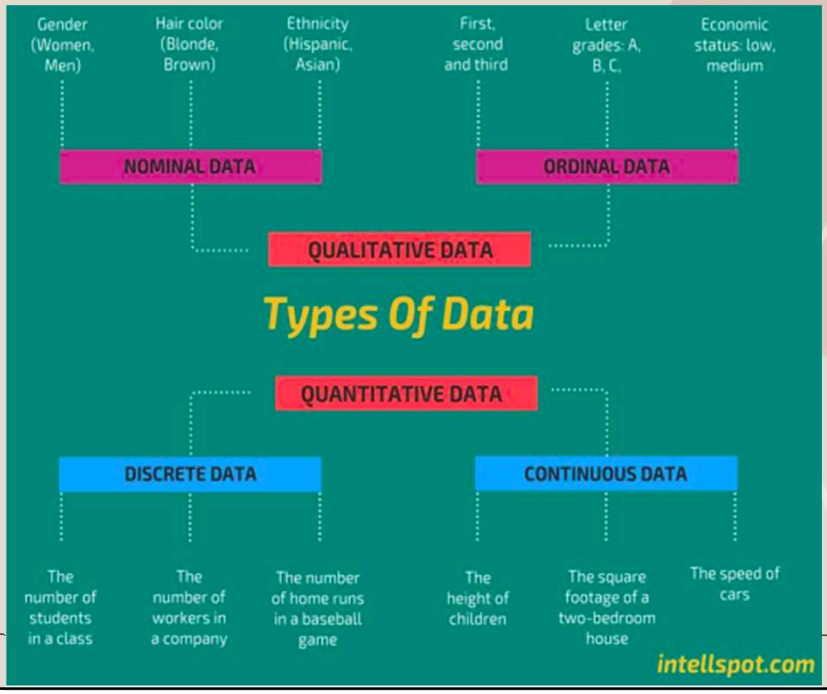
5	6/19/2022 18:34:09	[redacted]	أنثى	23	المرحلة الخامسة	نعم	3	2	2	2	
6	6/19/2022 18:42:55	[redacted]	أنثى	24	المرحلة الخامسة	نعم	2	2	1	0	
7	6/19/2022 20:02:32	[redacted]	ذكر	24	المرحلة الخامسة	نعم	3	3	3	3	
8	6/19/2022 20:31:07	[redacted]	أنثى	24	المرحلة الخامسة	نعم	3	0	1	3	
9	6/19/2022 23:17:36	[redacted]	أنثى	24	المرحلة الخامسة	نعم	3	2	2	1	
0	6/20/2022 1:58:01	[redacted]	ذكر	23	المرحلة الخامسة	نعم	1	2	1	1	
1	6/20/2022 12:34:13	[redacted]	ذكر	20	المرحلة الثالثة	لا	1	2	3	0	
2	6/20/2022 12:34:32	[redacted]	ذكر	21	المرحلة الثالثة	لا	0	0	0	0	
3	6/20/2022 12:36:26	[redacted]	ذكر	23	المرحلة الثالثة	لا	1	0	0	0	
4	6/20/2022 12:36:44	[redacted]	ذكر	22	المرحلة الثالثة	لا	2	1	1	0	

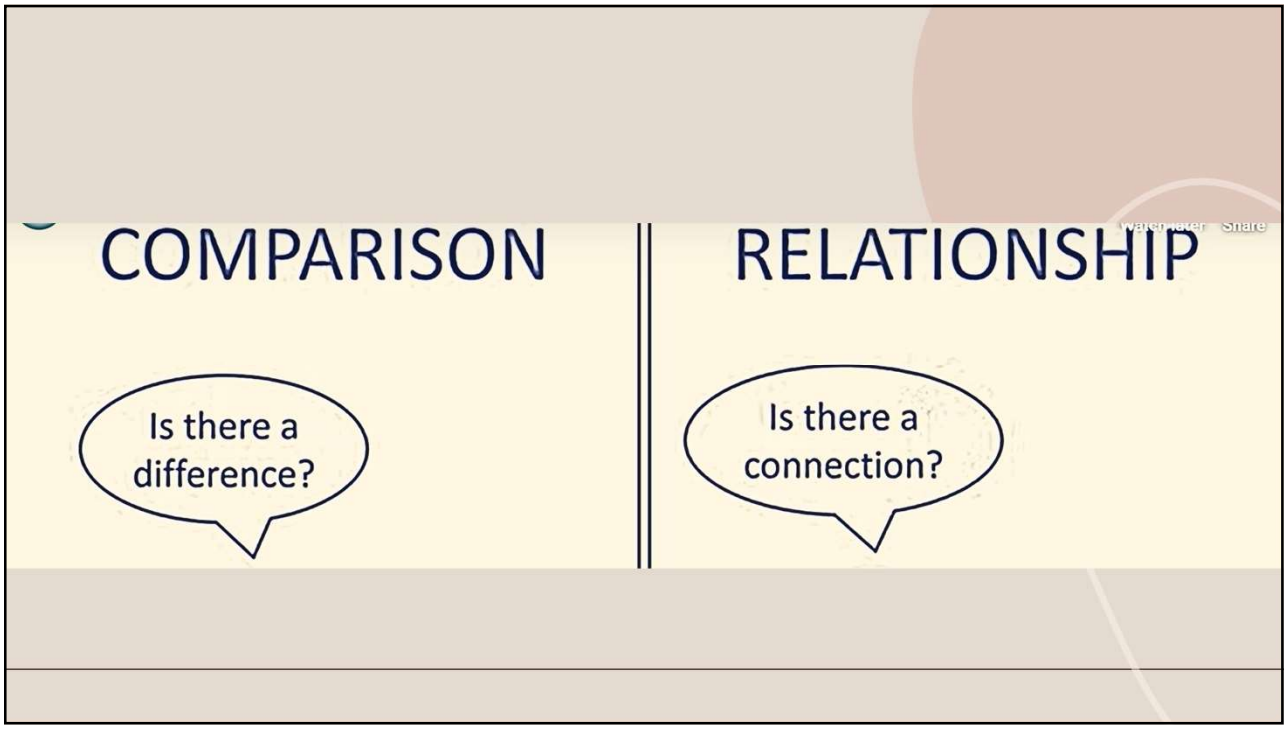
Constructing tables and graphs
Table -1 general charateristics

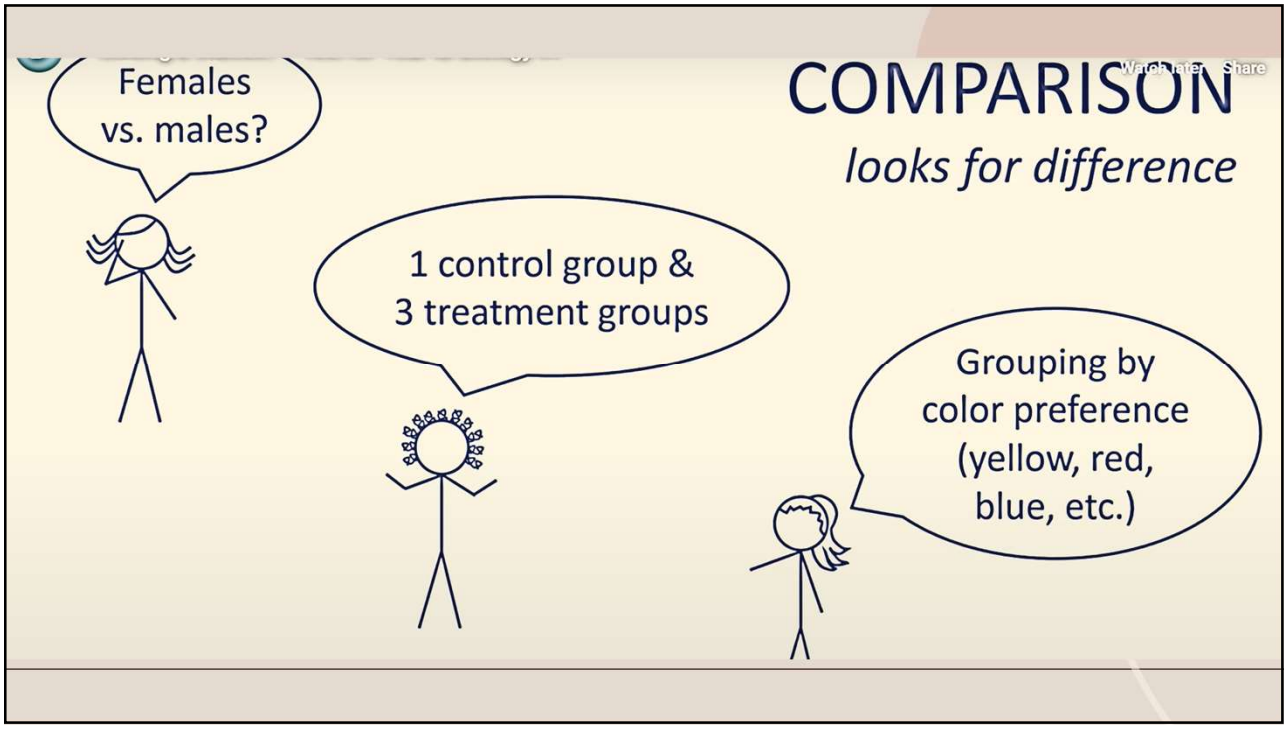
		No(%)
Age : Mean (SD)		56(10)
Gender	Male	60(30)
	Female	140(70)
Educational level	College	30(15)
	Secondary school	70(35)
	Primary school	100(50)

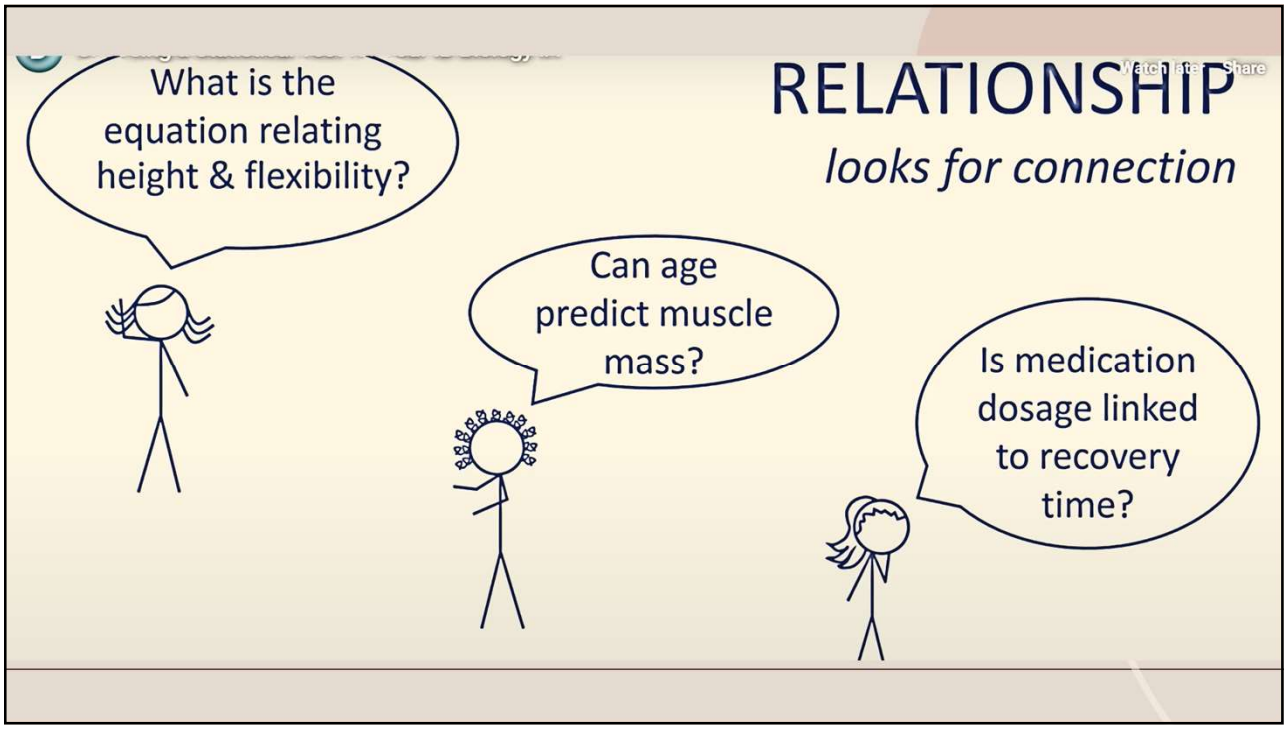
Table 2
Outcome and exposure

Outcome	Smoking	Non-smoker	P-value.
Periodontitis	No(%)		
Healthy			




COMPARISON
Is there a difference?
RELATIONSHIP
Is there a connection?


Females vs. males?
1 control group & 3 treatment groups
Grouping by color preference (yellow, red, blue, etc.)
COMPARISON
looks for difference



3 main types of statistical test families

Chi squared	T-test	Correlation

3 main types of tests families

Ask yourself two questions:

1- what is the main research question?

Comparison or relationship?

2- what type of data do you have?

Categorical (qualitative) or continuous (quantitative)?

Chi-squared	T-test	Correlation
Comparison	Comparison	Relationship
Categorical only	Categorical AND continuous	Continuous only

Chi-squared	T-test	Correlation
Any number of levels /gps	1 level = • 1-sample t-test, • Wilcoxon	1 IV& 1DV • Pearson's correlation, • Spearman's correlation, • regression
	2-samples • unpaired t-test, Mann Whitney	
	2-samples • paired t-test • Wilcoxon	
	+3 levels • One way ANOVA test, • Kruskal Wallis	

T test

- A t-test is a statistical test that is used to compare the means of two groups. It is often used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another.

ANOVA

- Analysis of variance, or ANOVA, is a statistical method that separates observed variance data into different components to use for additional tests.
- A one-way ANOVA is used for three or more groups of data, to gain information about the relationship between the dependent and independent variables.

Odds ratio

- Assess the risk or the likelihood.
- Odds ratio (OR) is a measure of association between an exposure and an outcome.
- The OR represents the odds that an outcome will occur in a group of people who exposed to a certain factor, compared to the odds of the outcome occurring in the absence of that exposure. In case-control studies, we divide the population study into cases and controls. Then count the number of participants in each group who exposed to the factor under assessment (RF).
-

- For example: A case-control study has been conducted including 1000 participants to assess the association between periodontitis and smoking. The study population has been divided into cases with confirmed periodontitis and control healthy subjects. In each group smokers have been identified.

		Smokers	Non-smokers	
	A	Exposed	Non-exposed	C
Periodontitis	Diseased	155	25	180
Healthy	Healthy	340	480	820
	B	495	505	1000
		B	D	D

Fig: Assessing the likelihood of disease occurrence

OR=AD/BC= 155*480/340*25= 8.75

- OR=1 Exposure does not affect odds of outcome
- OR>1 Exposure associated with higher odds of outcome
- OR<1 Exposure associated with lower odds of outcome

Example

Group	Mean GI in week1	Mean GI in week 2	P-value for ….???
Normal weight			
Obese			

Example

Case	Smoker	Non-smoker	P-value
Periodontitis			
Healthy			

Example

Group	Healthy	Mild periodontitis	Moderate	Severe	P-vale…?
Smoker					
Non-smoker					

Useful websites

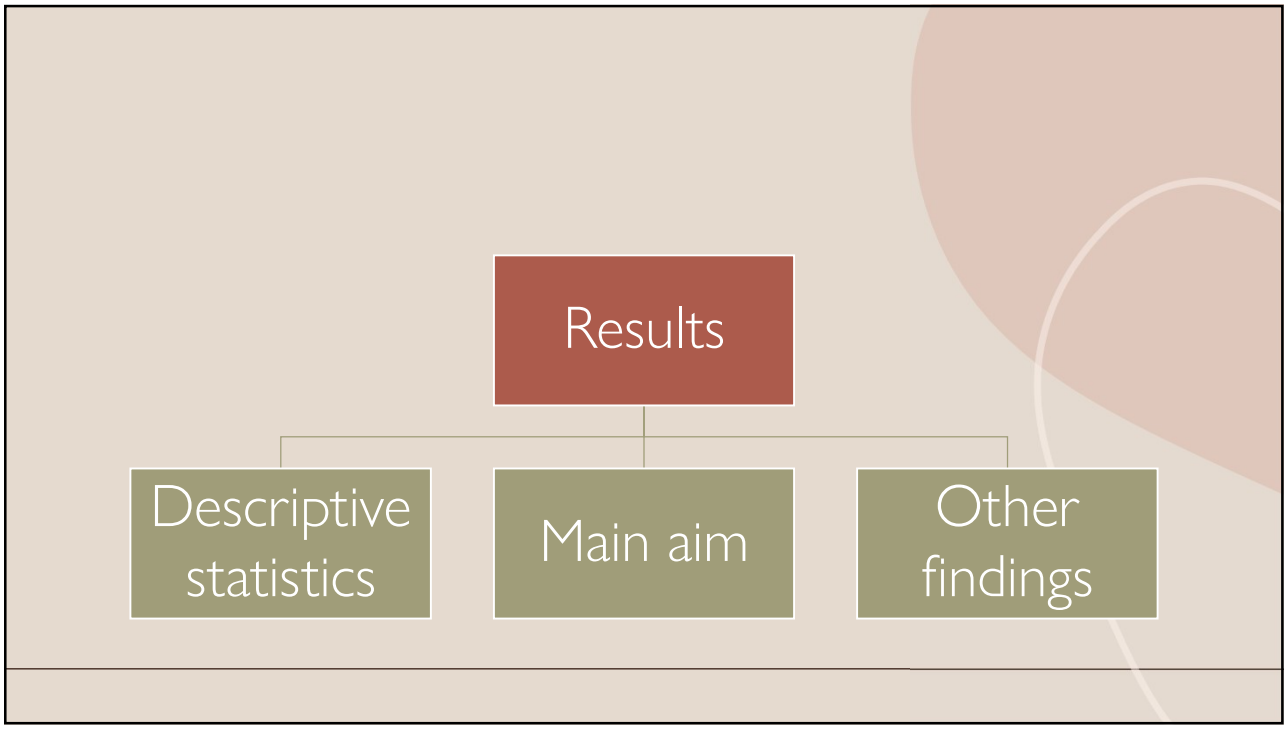
- https://calculator-online.net/statistics/
- https://www.graphpad.com/quickcalcs/
- https://www.socscistatistics.com/tests/

Interpretation

- P-value?
- What does it mean?
- GI and weight p-value significant
- A p-value is used in statistics as a measure of the probability that an observed difference could have occurred just by random chance.

Important note

- When can we say it is statistically significant?
  - P value < 0.05
- In P value < 0.001 we can describe our findings as " Highly significant"



Descriptive statistics

- Start with describing the general characteristics of your population
  - No. of participants
  - % of participation
  - Causes of withdrawal
  - Age range , mean (SD)
  - Male/female ratio
  - Socioeconomic status, education level

100 subjects 48.7 ± 12.8 (range: 18–71) years of age, 36% males, with an average of 27 ± 4 teeth (26 subjects had additionally 1 or more dental implant), were included. 17 of the 100 subjects who received the I-Brush and the App never produced any data. The periodontal classification of the 83 subjects who kept the App transmission function activated included 15 non-periodontitis subjects (healthy or localized gingivitis), 9 stage I periodontitis, 15 stage II, 39 stage III and 5 stage IV. Figure 1 shows the retention in I-

Tonetti MS, Deng K, Christiansen A, et al. Self-reported bleeding on brushing as a predictor of bleeding on probing: Early observations from the deployment of an internet of things network of intelligent power-driven toothbrushes in a supportive periodontal care population. J Clin Periodontol. 2020;47(10):1219-1226. doi:10.1111/jcpe.13351

Main aim

- The second part of the results include the main aim of the study
- Ex: relationship between periodontitis and smoking
  - Prevalence of smokers in cases and controls
  - How did you analyze relationship: Odds ratio, chi square…etc
  - P value
  - Be concise
  - Organize the variable according to the results
  - Ex: Periodontal parameters before and after treatment
    - Describe the parameters that decreased after treatment and then those which increased.

Table 1. Site-Specific PI in ALN and Placebo Groups at Baseline, 2 and 6 Months

	Baseline		2 Months		6 Months	
Plaque Scores	ALN Group n (%)	Placebo Group n (%)	ALN Group n (%)	Placebo Group n (%)	ALN Group n (%)	Placebo Group n (%)
0	0 (0)	0 (0)	24 (70.6)	26 (72.2)	27 (79.4)	31 (86.1)
1	11 (32.4)	11 (30.6)	10 (29.4)	10 (27.8)	7 (20.6)	5 (13.9)
2	14 (41.2)	14 (38.9)	0 (0)	0 (0)	0 (0)	0 (0)
3	9 (26.5)	11 (30.6)	0 (0)	0 (0)	0 (0)	0 (0)
P value†	0.143		0.023*		0.553	

* Statistically significant at $P < 0.05$. † χ^2 test.

Pradeep, A.R., Sharma, A., Rao, N.S., Bajaj, P., Naik, S.B. and Kumari, M. (2012), Local Drug Delivery of Alendronate Gel for the Treatment of Patients With Chronic Periodontitis With Diabetes Mellitus: A Double-Masked Controlled Clinical Trial. Journal of Periodontology, 83: 1322-1328. https://doi.org/10.1902/jop.2012.110292

Other aims

- Add the description of the findings for any other aim that you tested

General notes

- Use past tense
- Be Concise
- Be Objective
- Do not give your own interpretation
- Describe the results with numbers and values
- Refer to the tables in the relative paragraph

Few more tips

- The results section should be a relatively brief overview of your findings, not a complete presentation of every single number and calculation.
- Be sure to mention all relevant information.
- Remember not to include any table or figure without describing its content in the results

Thank you

Discussion

Dr Hadeel Mohammed Abbood

Its time to discuss

- It is important to distinguish between results section and discussion section
- Do not repeat the results
- Compare your results with others
- Discuss scientifically the suggested underlying explanation
- Show your strength and limitation points in your study
- Be honest
- Marketing your work

1.

Summarize your key findings

- Reiterate your research problem
- Summarize your major findings

2.

Share your interpretations

- Identify patterns, and relationships among your data
- Discuss whether the results met your expectations
- Contextualize your findings within previous research
- Explain unexpected results
- Consider possible alternative explanations

3.

Discuss the implications

- Show the relevance and implications of your research
- Relate your results back to previously discussed literature and existing knowledge
- Explore what new insights your research contributes

4.

Acknowledge the limitations

- Provide a picture of what can be concluded from your study
- Evaluate any impact limitations had on your research
- Explain why your results are still valid for answering your research question

- Is the study design appropriate?
- How well was the study conducted?

Sources of bias:

- Selection - comparability of groups
- Performance - care provided to each group
- Measurement - outcome assessment
- Attrition - dropouts/withdrawals
- Confounding- A factor that affect the outcome and esposure at the same time

5.

State your recommendations

- Make recommendations for practical implementation
- Give concrete ideas for future research

Conclusion

- Give your final conclusion
- Suggest for further study designs
- Highlight any health advice to health practitioners, health authorities, or community.

Thank you