"Iuliu Haţieganu" University of Medicine and Pharmacy, Cluj-Napoca
Discipline of Medical Informatics and Biostatistics

The methodology of scientific research in dental medicine

Cosmina Ioana Bondor – author

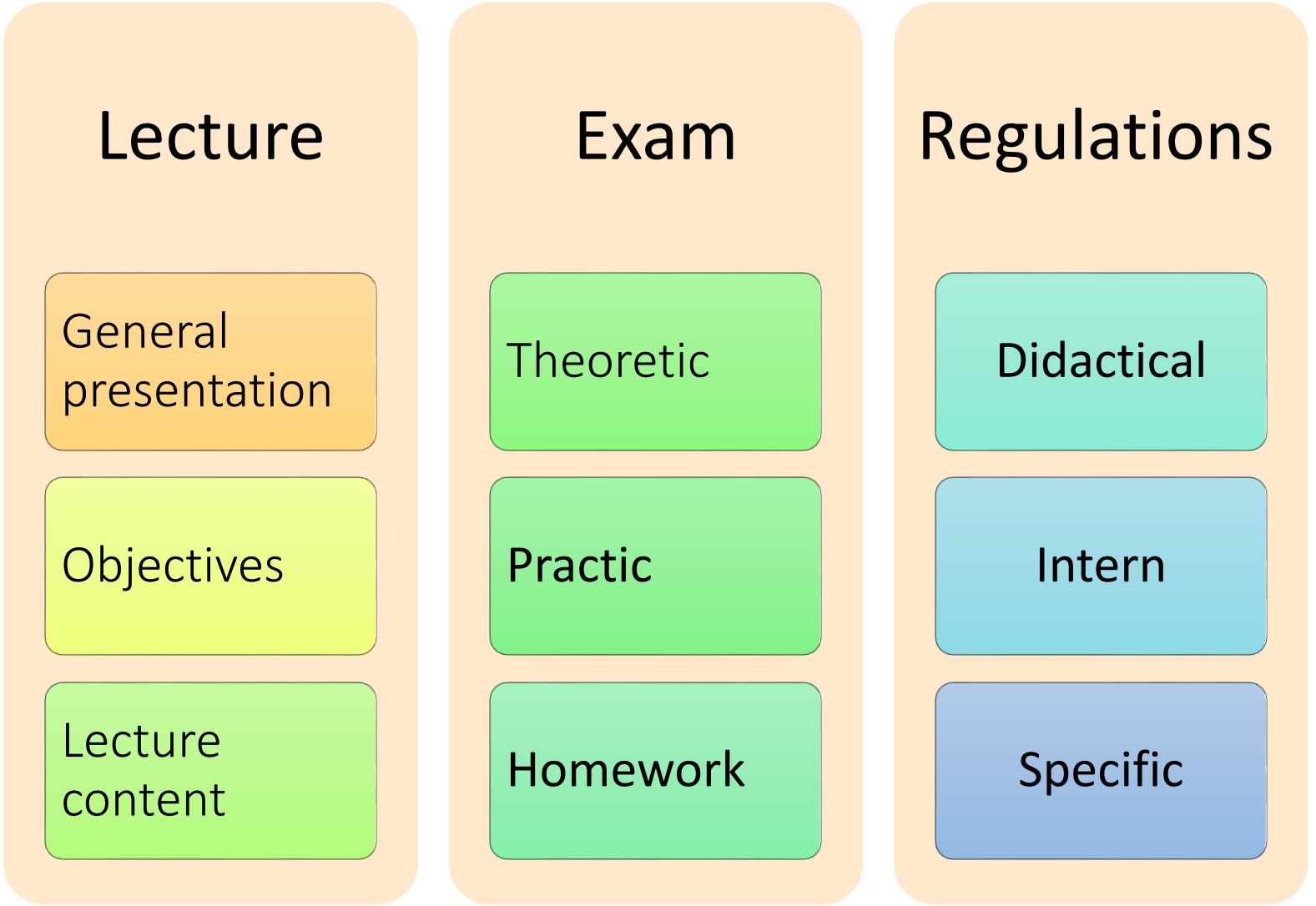
Introduction, Variables, Bibliographic study, Vancouver style for References

A ALWAYS

S SEEK

K KNOWLEDGE

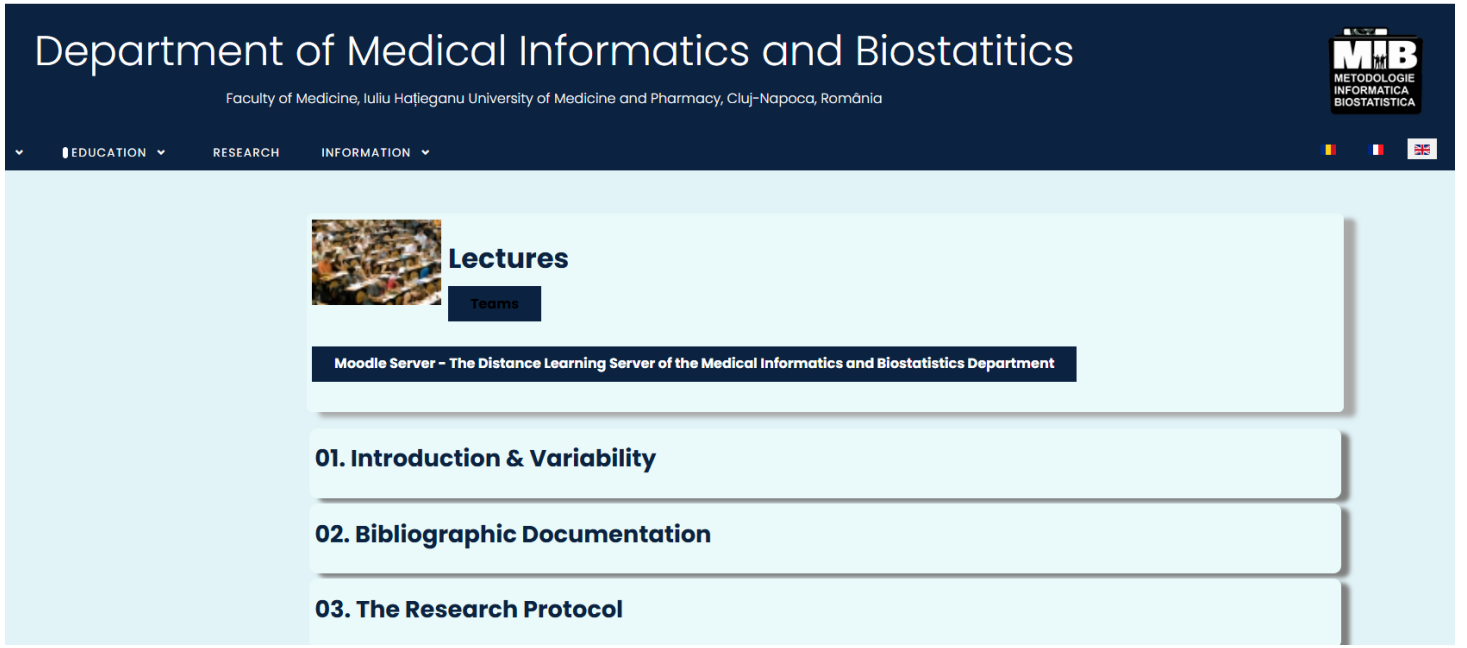
Aim of this presentation:



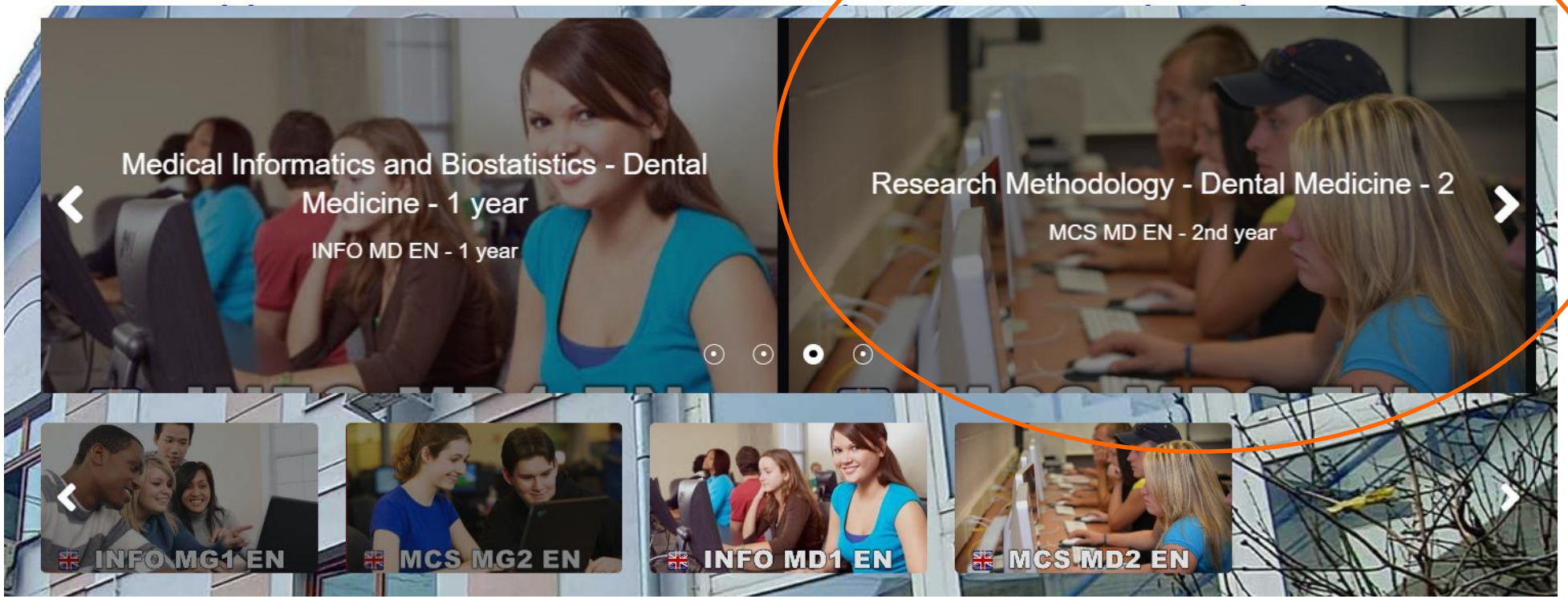
Teams: Bondor Cosmina Ioana

Contact: cbondor@umfcluj.ro

- General informations
  - 14 lectures of 1 hour.
    - 70% presence compulsory
  - slides publish at:
- www.info.umfcluj.ro
- Theoretical test
  - during examination session

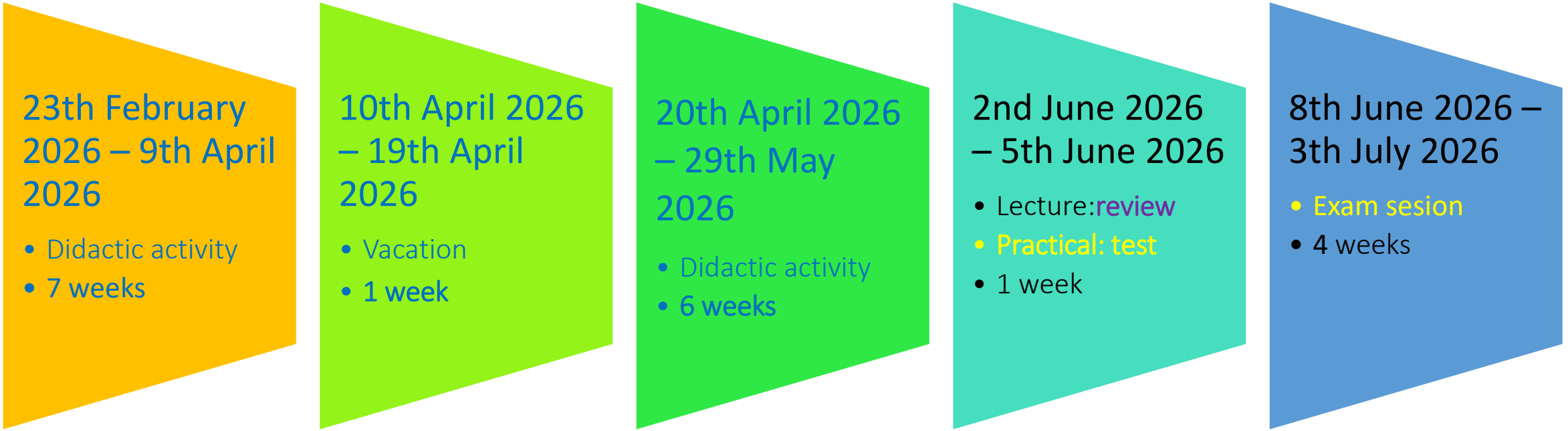


- General informations
  - 14 practical activity of 2 hour.
  - 100% compulsory
  - Publish at:



Practical test
14th week

SEMESTER II



- 14 Lectures of 1 hour:
  - Week 1-13 – didactical activity
  - Week 14 – Final Review

- 14 Practical activity of 2 hours:
  - Week 1-12 – didactical activity
  - Week 13 – Final Recap
  - Week 14 - Practical test

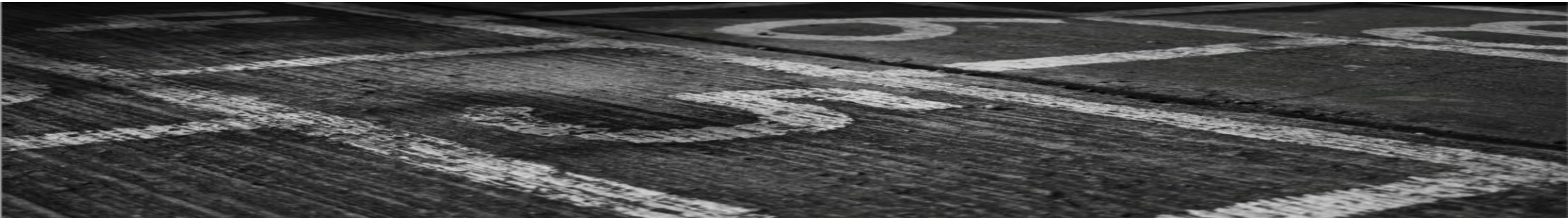
Week	Data	Lectures
01	24th February	C01 – Introduction. Variability. Bibliographic documentation
02	3rd March	C02 – Research protocol
03	10 th March	C03 – Clinical studies – Case control/Exposed-unexposed studies
04	17th March	C04 – Clinical study – diagnostic evaluation
05	24th March	C05 – Clinical study – therapeutical approach
06	31th March	C06 – Clinical study – survival
07	7th April	C07 – Second research
08	21th April	C08 – Statistical multivariate methods
09	28th April	C09 – Medical writing
10	05th May	C10 – Licence thesis I
11	12th May	C11 – Licence thesis II
12	19th May	C12 – Erors in scientific research. Ethical principles in medical research
13	26th May	C13 – Study hierarchy, medical evidence
14	2nd June	C14 – Recapitulation


Re-examination session I
13th July 2026 – 17th July 2026
Re-examination session II
14th Septembre 2026 – 18th Septembre 2026

REGULATIONS

- **Lecture**
  - Minimum 70% attending
  - The presence situation will be taken
- **Practical activities**
  - Minimum 100% attendance
  - The presence situation will be taken
  - Maximum 3 absences
    - Medical motivation and/or with payment till 12 January 2024
    - Recuperation till 12 January 2024

! All practical activities must be done



REGULATIONS

- **Exemption from the practical part of the exam !!!**
- Students who
  - Didn't recuperate all the absences in time
  - Have more than 3 absences at LP
  - Suspended
    - see the internal rules
      - rules which will be presented at the LP

- **Exemption from the theoretical part of the exam !!!**
- Students who
  - Didn't pass the practical exam
  - Did not attend minimum 70% of the lectures

Evaluation

Activity type	Evaluation criteria	Evaluation methods	Weight of the final grade
Theoretical test	Consistent with educational objectives	In conformity with the university regulations	**70%**
Practical test	Consistent with educational objectives	In conformity with the university regulations	**30%**
Minimum mark = 5 at both exams			

Practical test

- 15-20 minute
  - analysis of a study protocol similar to those taught at LP

Theoretical test

- multiple choice questions
- 0.6 extrapoints for Homeworks (quiz on Teams)

Theoretical exam - 40 questions: 100 minutes to respond

8) * The following are days of incubation for a contagious disease: 7; 3; 4; 7; 6; 6; 4; 5; 3; 7; 5; 4; 7; 6; 2; 3; 5; and 6. Coefficient of variation is equal to:
a) 0.32
b) 0.23
c) 0.27
d) 0.29
e) Could not be calculated based on provided data

Only one correct !

7) The following data represent the age of first episode of myocardial infarction on a series of male patients: 38, 50, 23, 45, 70, 33, 25, 40, 50, 62, and 59. The values of quartiles are as follows: Q1 = 35.5, Q2 = 45 and Q3 = 54.5. The following statements are true:
a) Q2 - Q1 = 9.5
b) Q3 - Q2 = 9.5
c) Data are asymmetrical distributed
d) Data are symmetrical distributed
e) Data are approximately symmetrical distributed

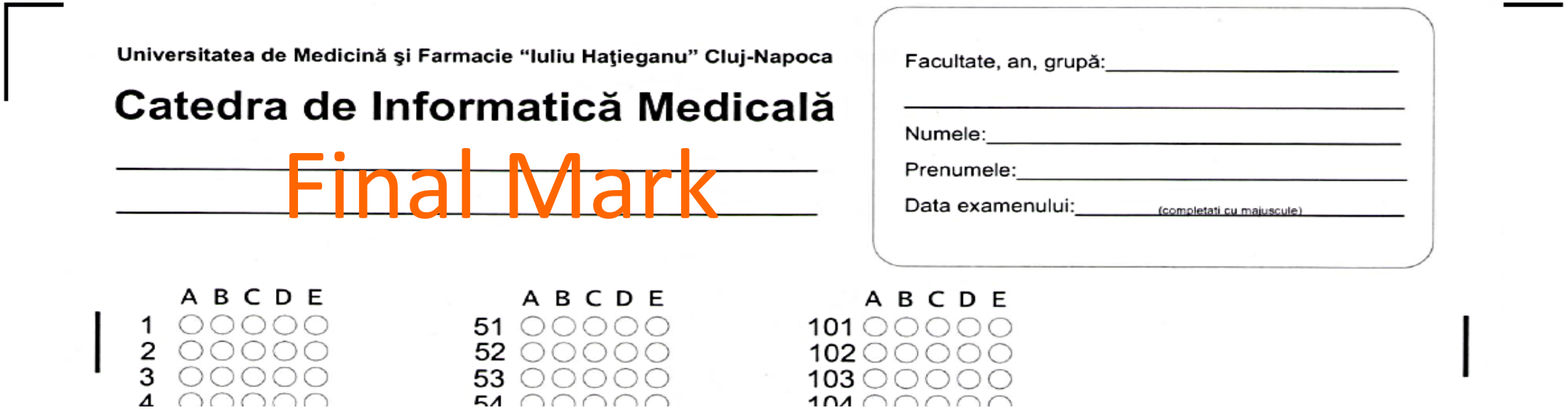
>2 answers correct !

16) Let be a statistical series with the following data: 40, 60, 20, 20, 60, 80, 80, 40, 60, and 80. The relative frequency of 0.3 corresponds to:
a) 20
b) 40
c) 60
d) 80
e) None is correct

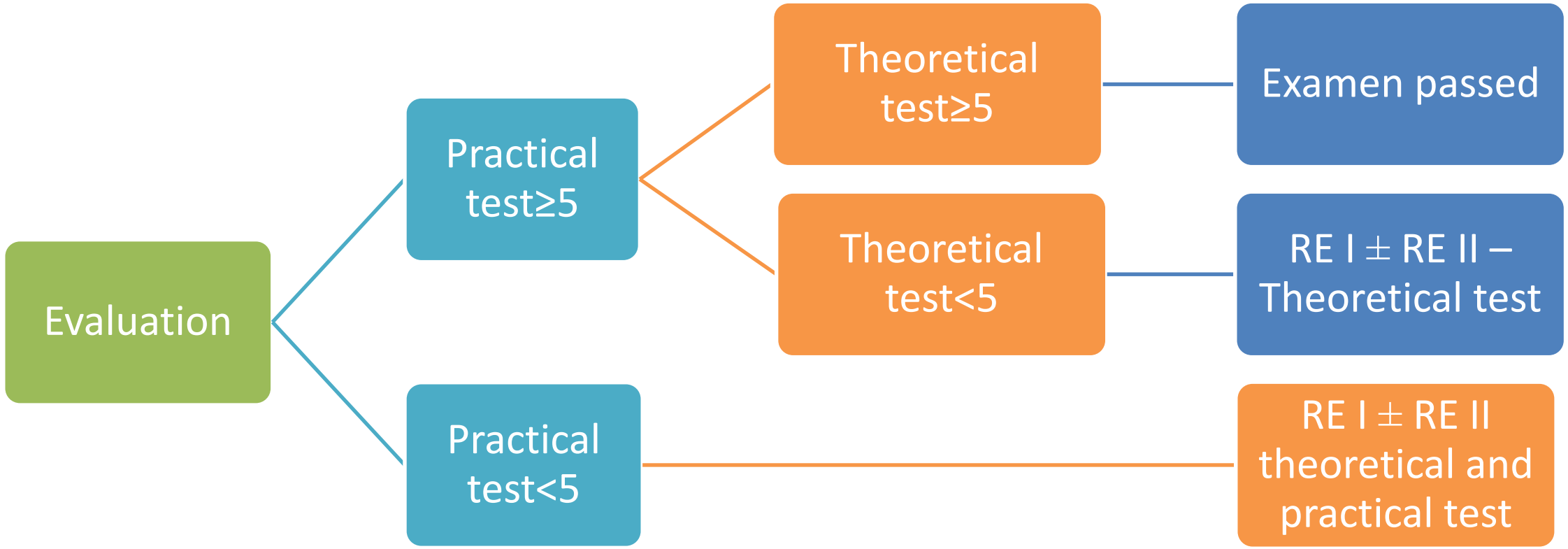
Two correct answers !

Final Mark

- If the student obtain
  - minimum 5 at practical part of the exam
  - respectively minimum 5 at theoretical part of the exam
- The final mark will be computed



- If the student obtain
  - minimum 5 at practical and theoretical test
- The final mark will be computed
  - Weighted mean = 0.70*theoretic test mark+0.30*practical test mark+points for homework (max. 0.6)

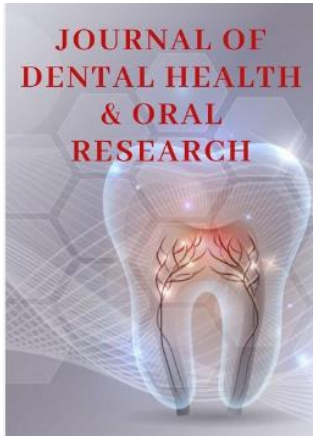

Evaluation
Practical test≥5
Practical test<5
Theoretical test≥5
Theoretical test<5
Examen passed
RE I ± RE II – Theoretical test
RE I ± RE II theoretical and practical test

Course objectives

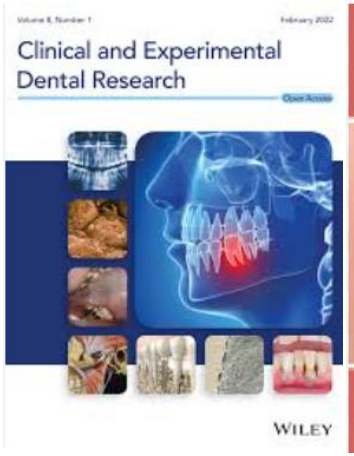
- Developing skills:
  - **Internet** resources for improving dental healthcare
  - **Making/understand** research
  - Presenting research results
    - printed form
    - oral form

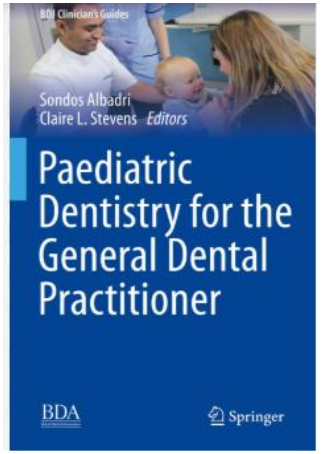
Why research?

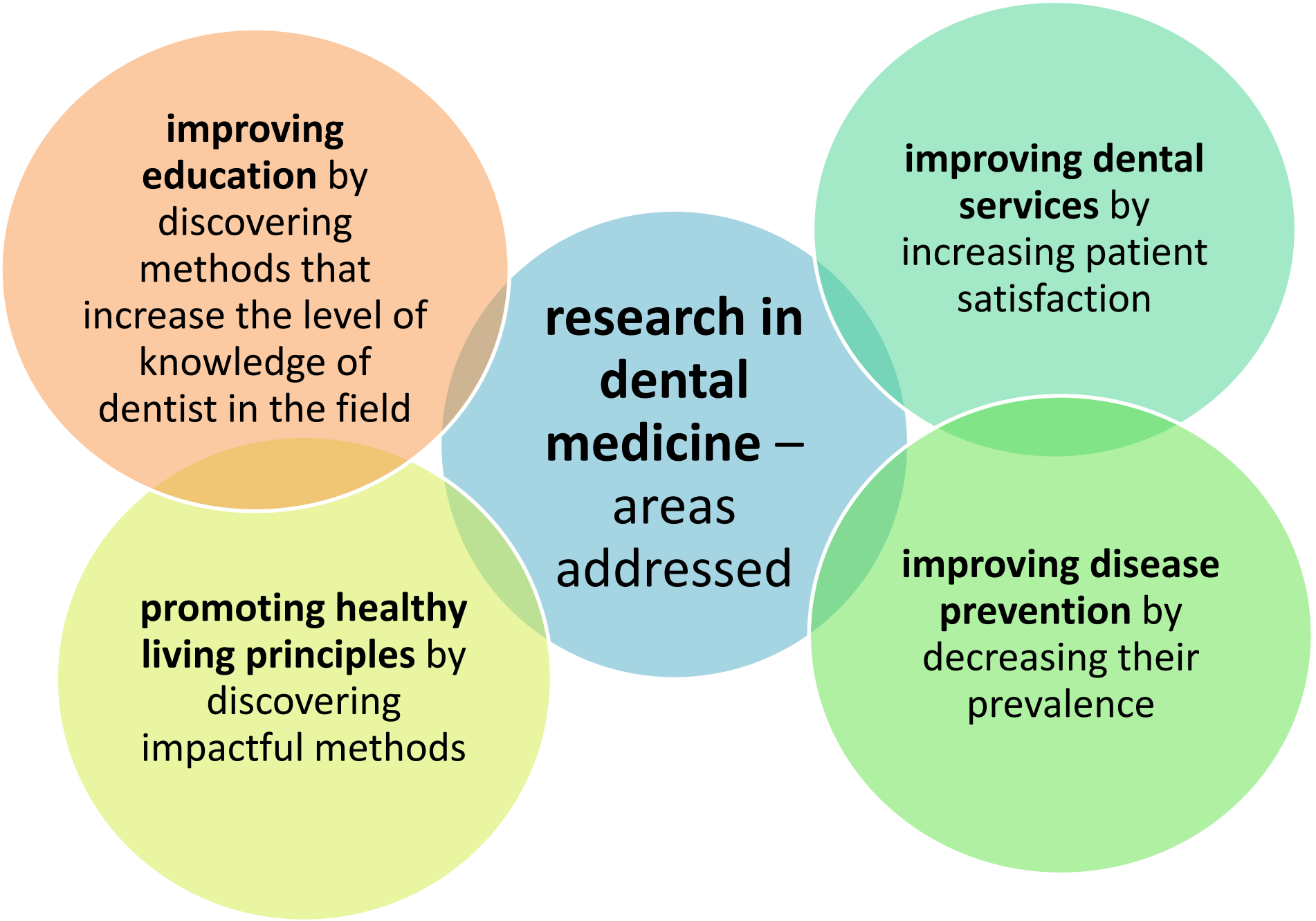
- Do dentists do research?



Yes






improving education by discovering methods that increase the level of knowledge of dentist in the field
research in dental medicine – areas addressed
improving dental services by increasing patient satisfaction
promoting healthy living principles by discovering impactful methods
improving disease prevention by decreasing their prevalence

Documentation	•Information •Introduction (of the bachelor's thesis)
Knowing the types of studies	•Writing the bachelor's thesis •Understanding the literature
Understanding the results	•Continuous Learning •Increasing the Quality of Patient Care
Errors in medical studies	•Fake news, mistakes, interests •Developing a critical eye

Why we need research?

- things in life/lives tend to repeat (nature is repetitive)

  → we can predict events (to some extent)

- Events have a cause (nature is deterministic)
  - we can study causality (is there a cause?)
  - highlighting causality (is this the cause?)
  - quantifying causality (how big is the effect?)

Why we need research?

!!!New situations in health arise all the time

- unknowns = always
  - or few studies,
  - or uncertain results
  - or worst, contradictory results
  - or not yet studied in all populations

Research in dentistry

- The patient has many characteristics = variables
  - experiments
  - interventions
  - observations
  - measurements

  } can be repeated in multiple patients

  - repeated in a sufficiently large number of patients → the truth about that **variability**

- Mathematical/statistical modeling of the results

Medical research = a scientific method

- follow strict rules/protocols
- based on observations → mathematical modelling with probabilities theory

- Hypotheses (questions):
  - Links between risk factors and health phenomena
  - Effectiveness of new diagnostic tests
  - Effectiveness and safety of new treatments

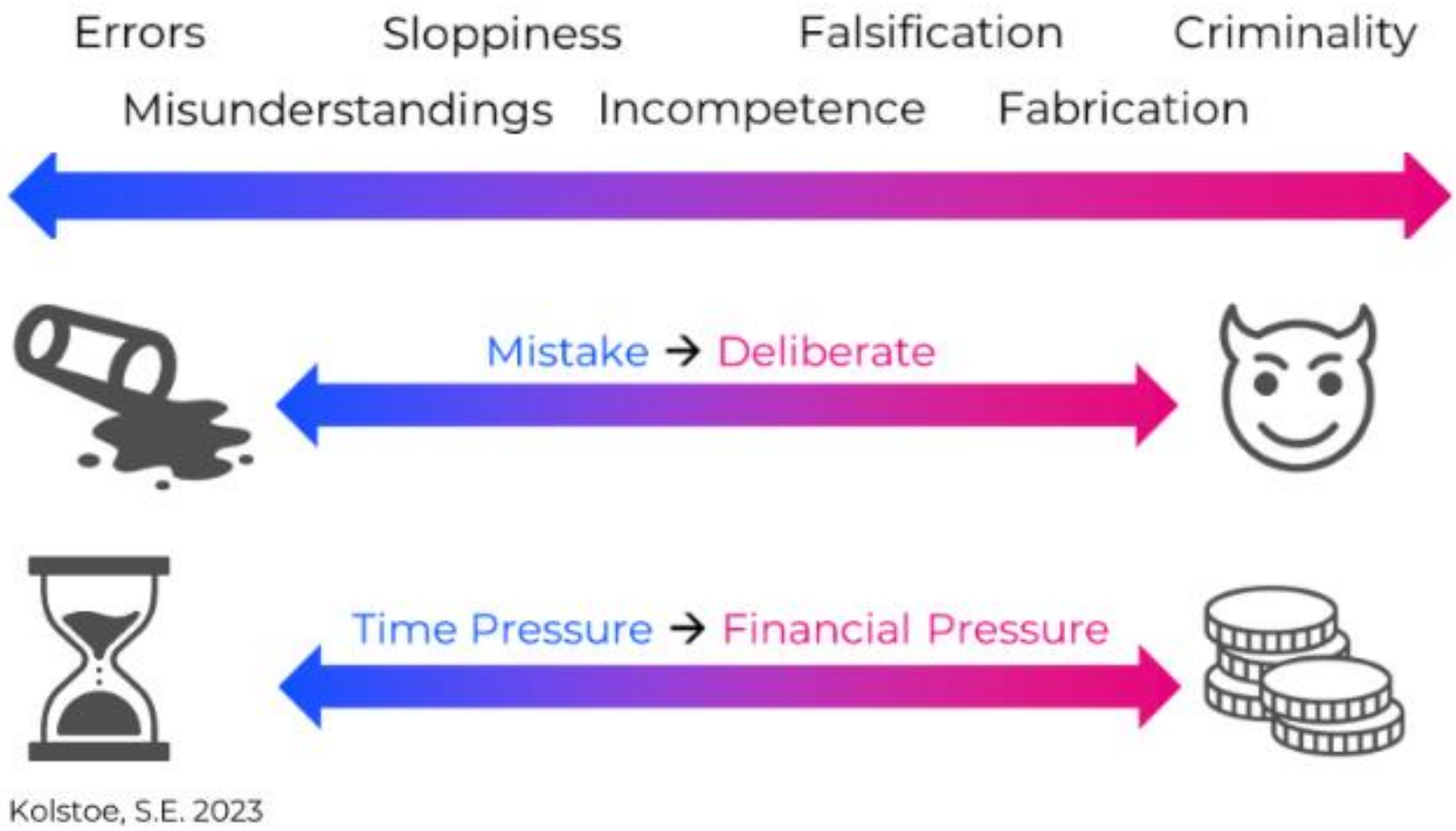
Medical research = a scientific method

- Hypothesis research:
  - Systematic = all the detail
  - Empirical = direct, objective observation
  - Controlled = the influence of certain disruptive factors is avoided
  - Critical = the results are public, exposed to criticism, corrections, validated/invalidated

  - Mistakes? Yes were/are/will be – corrected

Medical research = a scientific method

– Mistakes? Yes were/are/will be



Yes, there will be mistakes

- Developing a **critical eye** – necessary
- Inform yourself – things change

WHAT IS PEER REVIEW ?

ELISE GRAVEL & SIMON GRAVEL

1. This scientist studies something.

2. She writes an article about that thing.

3. She sends her article to a reputable science journal.

WHAT IS PEER REVIEW ?

ELISE GRAVEL & SIMON GRAVEL

4 The journal sends the article to many other scientists (they're called "peers".)

5 The scientists examine the article :

Is the research sound ?

Are there mistakes ?

Do I reach the same conclusions ?

WHAT IS PEER REVIEW ?

ELISE GRAVEL & SIMON GRAVEL

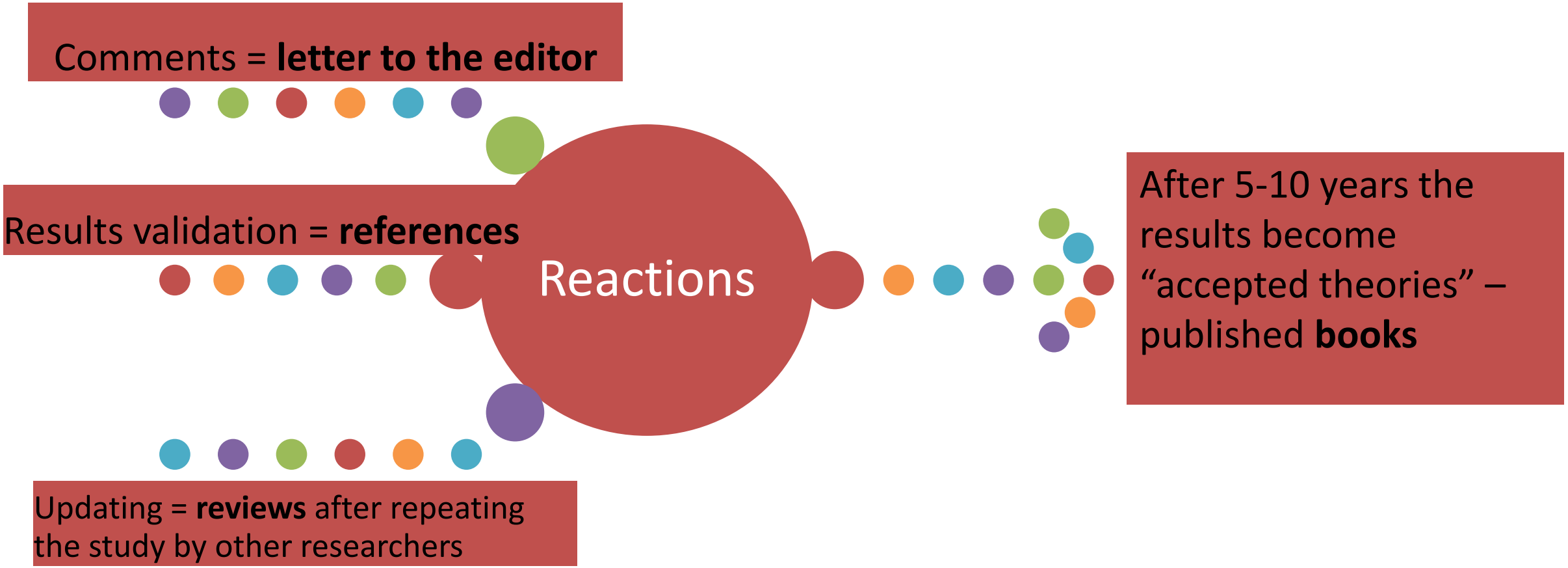
6 Criticisms are sent to the scientist, who can make corrections. That can take years !

7 The journal publishes the article.

8 People can read the article.

Experts and media tend to trust peer-reviewed research more because all these checks help avoid mistakes.

What's next?


Comments = **letter to the editor**
Results validation = **references**
Reactions
Updating = **reviews** after repeating the study by other researchers
After 5-10 years the results become "accepted theories" – published **books**

The dentist - Information is obtained

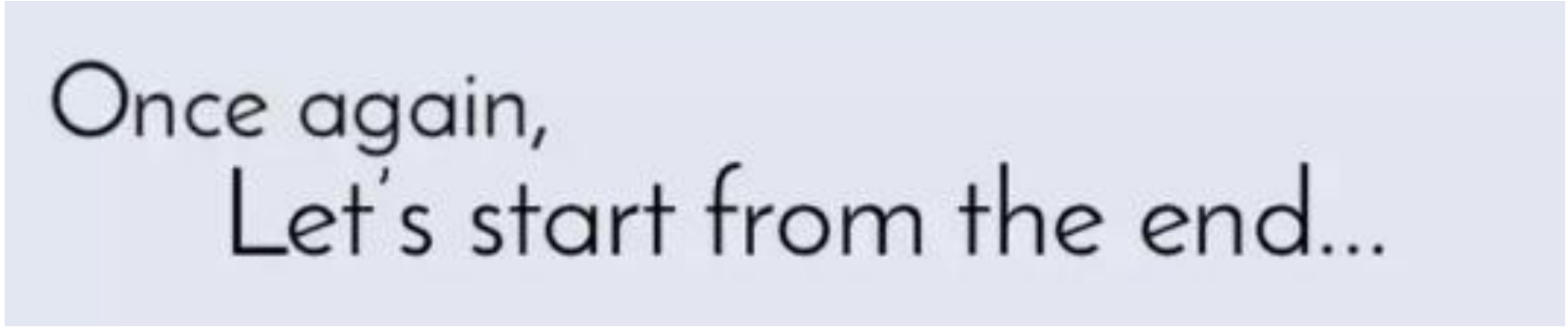
- from school/books
  - Advantage
  - Disadvantage

- from articles/reviews
  - Advantage
  - Disadvantage

The dentist - Information is obtained

- from school/books
  - Advantage
    - high degree of **validity**
    - high degree of **safetiness**
  - Disadvantage
    - possibly **outdated** methods
    - **takes time**

- from articles/reviews
  - Advantage
    - The patient have benefits
    - modern office
    - Faster
  - Disadvantage
    - **insufficiently** tested
    - requires **critical analysis** of research
    - It is difficult to manage the **amount of publications**



https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.yourquote.in%2Fvandana-yadav-bcxnd%2Fquotes%2Flets-start-end-p00kr&psig=AOvVaw1iY77mXygTyGW0LmtcxcId&ust=1677171326351000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCLDBp9jOqf0CFQAAAAAdAAAAABAJ

Cosmina Ioana Bondor – autor

Variables

Bibliographic study

Citing references

A **ALWAYS**

S **SEEK**

K **KNOWLEDGE**

Objective

- Bibliographic study
  - documentation on a topic
  - clinical question: PICO method
- References – citation
  - Vancouver style references

Variables = characteristics

- numerical = quantitative
  - discrete
    - decimals have no sense
  - continuous
    - with decimals
- qualitative
  - nominal
    - without order
    - more than 2 categories
  - dichotomial (binary)
    - only two categories
  - ordinal
    - categories can be order

- article = publication about a research
- the last chapter of an article

References

to do regular checkups.

Audiovisual distraction is found to be a powerful tool to manage anxious patients [3,13]. The patient feared injection so a visual and auditory distraction technique using an eye massager was tried. The eye massager relaxed the patient together with blocking the site from fearful stimuli. The dentist could patiently complete the procedure. Future research would concentrate on more patients to compare the effectiveness of massage therapy with other anxiety control methods.

Conclusions

Dental anxiety creates a stressful situation for the patient as well as the dentist. This article describes a simple technique to manage anxiety using an eye massager. The audio and visual distraction using the eye massager helped the patient relax and complete the procedure.

Additional Information

Disclosures

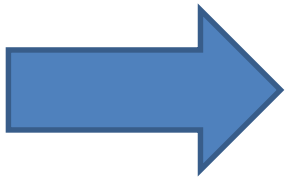
Human subjects: Consent was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

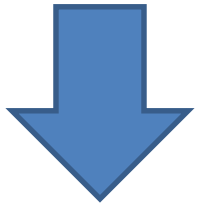
1. Armfield JM: Towards a better understanding of dental anxiety and fear: cognitions vs. experiences . Eur J Oral Sci. 2010, 118:259-64. 10.1111/j.1600-0722.2010.00740.x
2. Dionne RA, Gordon SM, McCullagh LM, Phero JC: Assessing the need for anesthesia and sedation in the general population. J Am Dent Assoc. 1998, 129:167-73. 10.14219/jada.archive.1998.0173
3. Colvenkar S, Ali MM: Management of gag reflex with a virtual reality headset . J Prosthet Dent. 2022, [In Press]:10.1016/j.prosdent.2022.04.014
4. Pohjola V, Lahti S, Vehkalahti MM, Tolvanen M, Hausen H: Association between dental fear and dental attendance among adults in Finland. Acta Odontol Scand. 2007, 65:224-30. 10.1080/00016350701373558
5. Armfield J: The avoidance and delaying of dental visits in Australia . Aust Dent J. 2012, 57:243-7. 10.1111/j.1834-7819.2012.01697.x
6. Sharif MO: Dental anxiety: detection and management. J Appl Oral Sci. 2010, 18:i. 10.1590/s1678-77572010000200001
7. Armfield JM, Slade GD, Spencer AJ: Dental fear and adult oral health in Australia . Community Dent Oral Epidemiol. 2009, 37:220-30. 10.1111/j.1600-0528.2009.00468.x

Why do we start with the end?

- at the beginning of the study
  - our (research) idea is correct?
  - how to prove it?



We read about the studied subject
(= Bibliographic study)



We collect references

Literature Search Strategy on Internet

- Summarize the topic in one or two sentences.
- Identify the unique ideas or concept associated with your topic.
- Choose appropriate keywords (terms you want to search) for each concept.

Pub Med Resource

- Medical Publications
- project of the USA National Institute of Health, National Library of Medicine
- It searches for you from about 21 million articles.

- http://www.ncbi.nlm.nih.gov/PubMed/

- **Free Medical Journals: websites**
  - http://www.lau.edu.lb/libraries/research-tools/free-journals-list.php.
  - www.freemedicaljournals.com/
  - http://highwire.stanford.edu/lists/freeart.dtl
  - DOAJ(Directory of open access journals): http://www.doaj.org/
  - MedIND (http://medind.nic.in/)

- **Medical Search Engines**
  - MedHunt (www.medhunt.com)
  - MedNets (www.mednets.com)
  - HealthAtoZ (www.healthatoz.com)
  - DoctorNet (www.doctornet.com)
  - MedConnect (www.medconnect.com)
  - OMNI (www.omni.ac.uk)
  - and many more…. Get a complete list by typing “medical search engines” in any good browser.

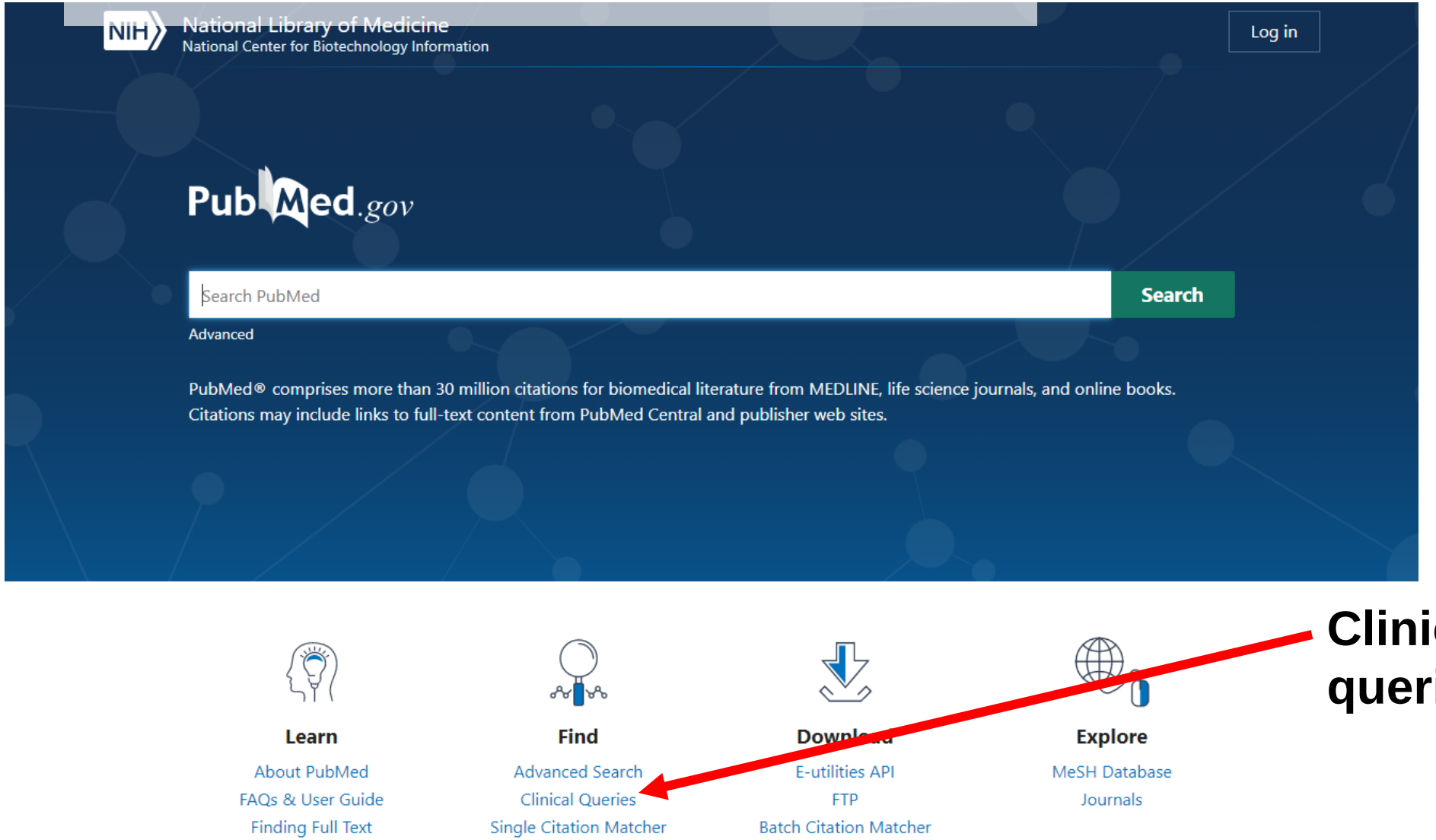
Some Good Medical Websites:

- www.medscape.com:
  - an excellent site for medical professionals. Free registration, access to specialty and subspecialty pages, full-text articles and the latest medical news and events.
- www.who.int:
  - the website of the World Health Organization. Provides the latest activity of the WHO, annual reports, bulletins,monographs, research funding reports and forms, global vital statistics and trends.
- www.cdc.gov:
  - the official website of the Centers for Disease Control (CDC) in Atlanta, Georgia, USA. It provides global information on a variety of diseases, chiefly infectious diseases, epidemiology and disease control. The statistical software Epi Info is available for download from this site.

Where do we read about the subject?

PUBMED

PubMed MEDLINE



Clinical queries

Formulated to find scientific articles and reviews on the topic

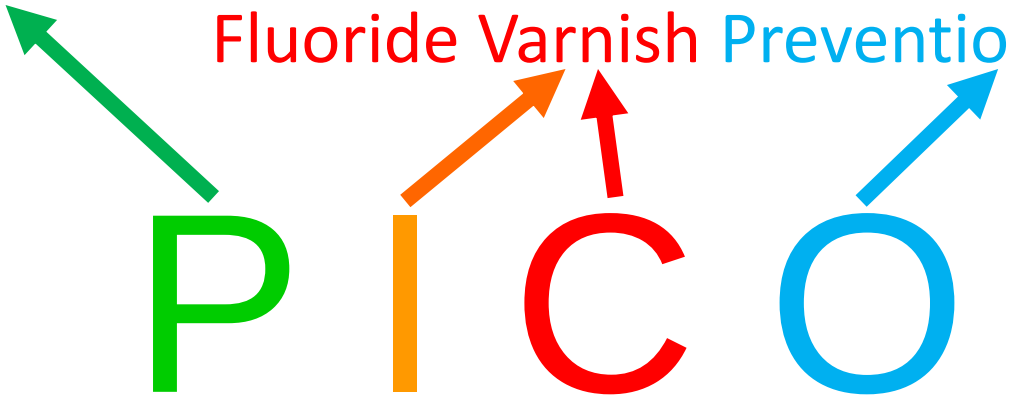
- A clinical question has 4 components:
  - P – Population or problem
  - I – Intervention or treatment of interest
  - C – Comparison or control
  - O – Output

P I C O

Ex. Clinical question made up of search keys from MESH:

Dental caries in children aged 3 to 5 Fluoride treatment AllSolutions

Fluoride Varnish Prevention



P – Population or problem
I – Intervention or treatment of interest
C – Comparison or control
O – Output

"What is the effectiveness of fluoride treatment in preventing dental caries in children aged 3 to 5 compared to fluoride varnish?"

Clinical queries

P - Population or problem

– what population is it about?

– what characteristics or demographic information such as age range, gender, presentation with a specific complaint and history.

e.g. Dental caries in children aged 3 to 5

I - Intervention or treatment of interest

- the intervention can be a treatment, a procedure, a diagnostic test, a risk factor, a prognostic factor.

- e.g. Fluoride treatment

C - Comparison or control

- a therapy (a treatment, a procedure, a diagnostic test, a risk factor, a prognostic factor) is compared with the existing one.

Ex. Fluoride Varnish (AllSolutions Fluoride Varnish)

O - Output

- effect of the intervention, side effect, complication, prevention of death, sensitivity, etc.

Ex. Prevention

Ex. Clinical question composed of search keys from MESH:

Children Infections Ampicillin Gentamicins Drug Resistance

Examples

"How does the efficacy of ampicillin compare to gentamicin in treating drug-resistant infections in children?“

PICO method

Children Infections Ampicillin Gentamicins Drug Resistance

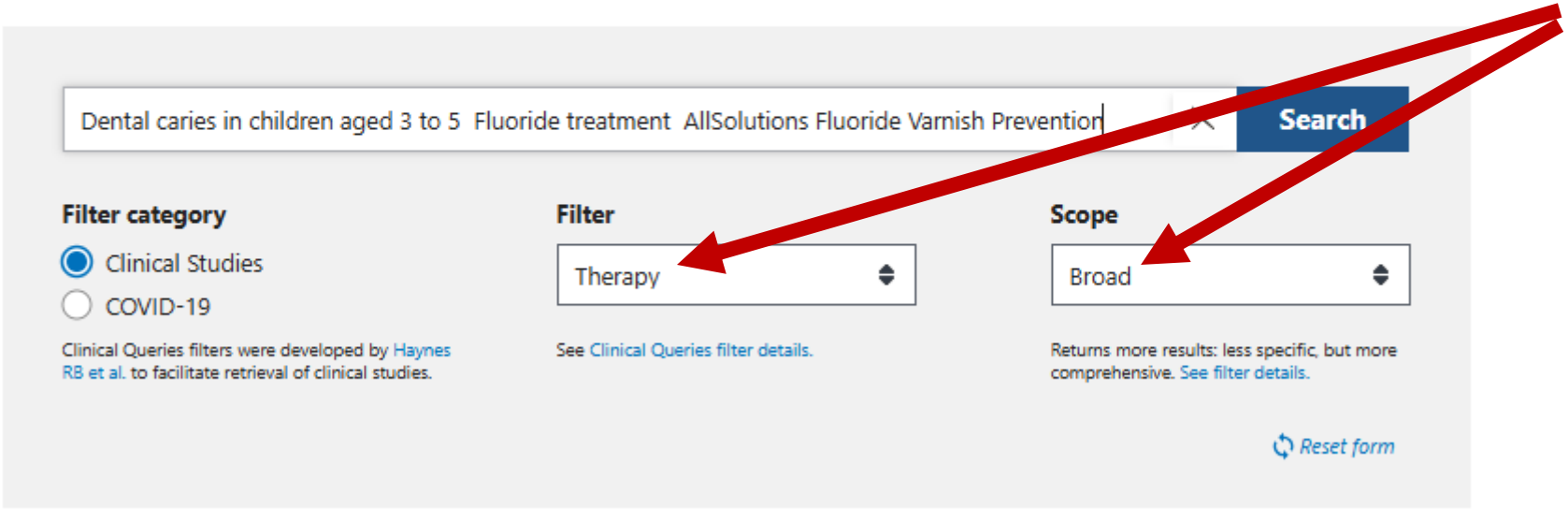
- "Does the early administration of intravenous antibiotics reduce the risk of mortality in patients with sepsis compared to delayed administration?“

PICO method

Sepsis Early administration of intravenous antibiotics Mortality risk

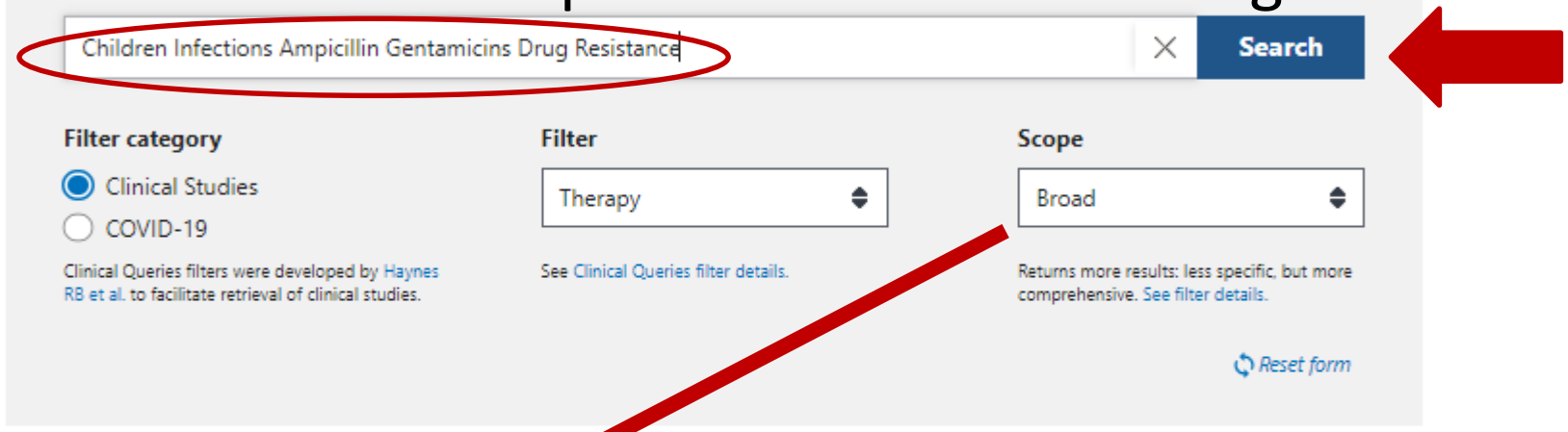
PubMed Clinical Queries

This tool uses predefined filters to help you quickly refine PubMed searches on clinical or disease-specific topics. To use this tool, enter your search terms in the search bar and select filters before searching.



Another example

Children Infections Ampicillin Gentamicins Drug Resistance



PubMed Clinical Queries

This tool uses predefined filters to help you quickly refine PubMed searches on clinical or disease-specific topics. To use this tool, enter your search terms in the search bar and select filters before searching.

Children Infections Ampicillin Gentamicins Drug Resistance

Search

Filter category

- (●) Clinical Studies
- ( ) COVID-19

Clinical Queries filters were developed by Haynes RB et al. to facilitate retrieval of clinical studies.

Filter

Therapy

See Clinical Queries filter details.

Scope

Narrow

Returns fewer results: more specific, but less comprehensive. See filter details.

Reset form

Results for Clinical Studies: Therapy/Narrow

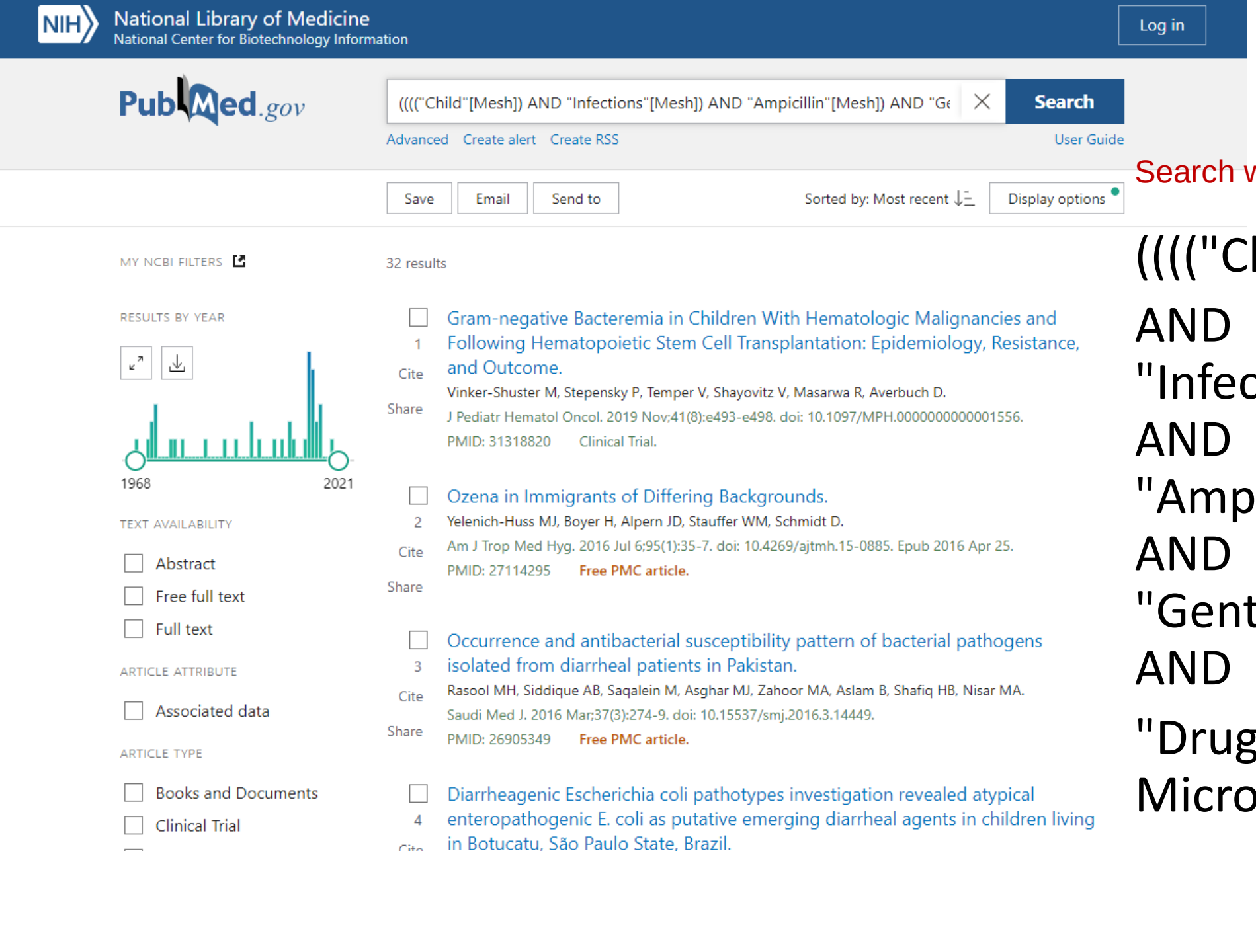
Narrow instead of Broad: less articles, more precise

5 of 8 results sorted by: Most Recent

See all results in PubMed (8)

Effects of early-life antibiotics on the developing infant gut microbiome and resistome: a randomized trial.
Reyman M, et al. Nat Commun. 2022. PMID: 35173154 Free PMC article. Clinical Trial.

Randomised controlled trial of fosfomycin in neonatal sepsis: pharmacokinetics and safety in relation to sodium overload.
Obiero CW, et al. Arch Dis Child. 2022. PMID: 35078765 Free PMC article. Clinical Trial.



MESH

Search with MeSH terms

((("Child"[Mesh])
AND
"Infections"[Mesh])
AND
"Ampicillin"[Mesh])
AND
"Gentamicins"[Mesh])
AND
"Drug Resistance, Microbial"[Mesh]

Introduction

Despite a better understanding of its etiopathogenesis and all the efforts undertaken over the last few decades to control it, dental caries is still the most prevalent chronic noncommunicable disease in the world.[1] As defined in a recent consensus paper, caries is a biofilm-mediated, multifactorial, dynamic disease driven by frequent intake of fermentable carbohydrates and characterised by phasic demineralisation and remineralisation of dental hard tissues. Carious lesions are caused via oral bacteria breaking down ingested carbohydrates and producing organic acids and other enzymes that induce demineralisation of tooth structures, eventually leading to cavitation or further destruction of the affected tooth structures.[2]

Preventive actions are focussed on minimising risk fac-

- references should be **numbered in the order of appearance** in the text

Introduction

Despite a better understanding of its etiopathogenesis and all the efforts undertaken over the last few decades to control it, dental caries is still the most prevalent chronic noncommunicable disease in the world.[1] As defined in a recent consensus paper, caries is a biofilm-mediated, multifactorial, dynamic disease driven by frequent intake of fermentable carbohydrates and characterised by phasic demineralisation and remineralisation of dental hard tissues. Carious lesions are caused via oral bacteria breaking down ingested carbohydrates and producing organic acids and other enzymes that induce demineralisation of tooth structures, eventually leading to cavitation or further destruction of the affected tooth structures.[2]

Preventive actions are focussed on minimising risk fac-

at the end of the paper, **a list** of numbered references should be added in a paragraph entitled “References”

of publications with similar measurements did not allow comparative statistics to be used across this range of studies. It is clear that more well controlled studies based on subject pool size, age, tooth location, and perhaps lesion size are needed to make sound comparisons amongst the materials analysed in this review.

Conclusions

More evidence has been gathered on the clinical efficacy of

REFERENCES

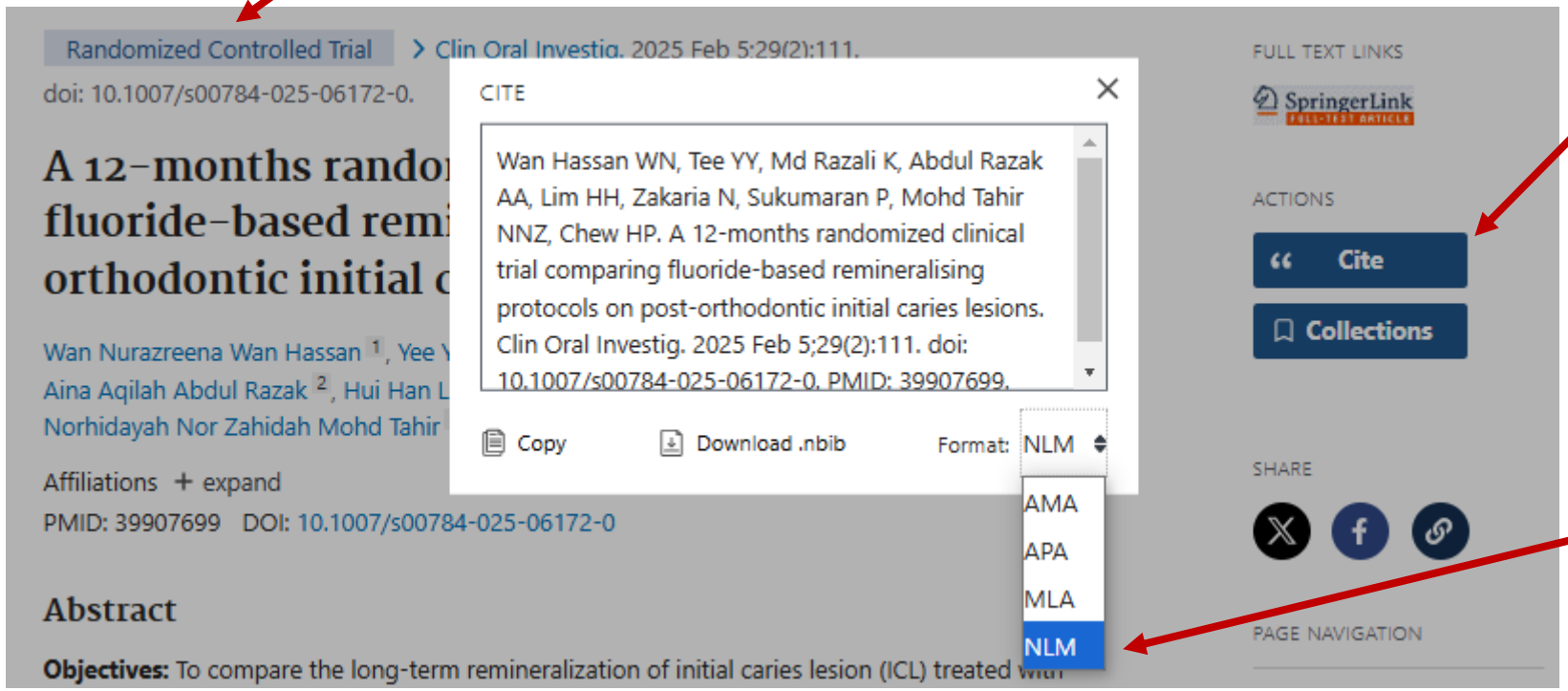
1. Sampaio FC, Bönecker M, Paiva SM, et al. Dental caries prevalence, prospects, and challenges for Latin America and Caribbean countries: a summary and final recommendations from a Regional Consensus. Braz Oral Res 2021;35(Suppl 1):e056. doi: 10.1590/1807-3107bor-2021.vol35.0056.
2. Machiulskiene V, Campus G, Carvalho JC, et al . Terminology of dental caries and dental caries management: consensus report of a workshop organized by ORCA and Cariology Research Group of IADR. Caries Res 2020;54(1):7–14. doi:

Citation/reference

- there are several approved citation styles
  - Vancouver
  - APA
  - MLA, etc.
- Our university has adopted Vancouver style
- PubMed has the same Vancouver style to cite

- the article

Click to obtain the reference



Reference style
NLM = Vancouver style

Vancouver style for references

- is a system of citing references (sources taken) used in the preparation of an article / review / book / thesis.

- the reference must be correct
  - correct – respecting the Vancouver style

Vancouver style for references

correct reference:

- **all elements** of the reference should be mentioned
- **the syntax** should be maintained: spaces, punctuation marks
- references should be **numbered in the order of appearance** in the text
- at the end of the paper, **a list** of numbered references should be added in a paragraph entitled “References”

- references should be **numbered in the order of appearance** in the text

Introduction

Despite a better understanding of its etiopathogenesis and all the efforts undertaken over the last few decades to control it, dental caries is still the most prevalent chronic noncommunicable disease in the world.[1] As defined in a recent consensus paper, caries is a biofilm-mediated, multifactorial, dynamic disease driven by frequent intake of fermentable carbohydrates and characterised by phasic demineralisation and remineralisation of dental hard tissues. Carious lesions are caused via oral bacteria breaking down ingested carbohydrates and producing organic acids and other enzymes that induce demineralisation of tooth structures, eventually leading to cavitation or further destruction of the affected tooth structures.[2]

Preventive actions are focussed on minimising risk fac-

at the end of the paper, **a list** of numbered references should be added in a paragraph entitled “References”

of publications with similar measurements did not allow comparative statistics to be used across this range of studies. It is clear that more well controlled studies based on subject pool size, age, tooth location, and perhaps lesion size are needed to make sound comparisons amongst the materials analysed in this review.

Conclusions

More evidence has been gathered on the clinical efficacy of

REFERENCES

1. Sampaio FC, Bönecker M, Paiva SM, et al. Dental caries prevalence, prospects, and challenges for Latin America and Caribbean countries: a summary and final recommendations from a Regional Consensus. Braz Oral Res 2021;35(Suppl 1):e056. doi: 10.1590/1807-3107bor-2021.vol35.0056.
2. Machiulskiene V, Campus G, Carvalho JC, et al . Terminology of dental caries and dental caries management: consensus report of a workshop organized by ORCA and Cariology Research Group of IADR. Caries Res 2020;54(1):7–14. doi:

The way you cite may be different

- emphasis on the author:

  ... more over Lawn [2] also states ....

- emphasis on the information

  ... 30% of neonatal sepsis is due to antibiotic-resistant bacteria [2].

The in-text citation is placed immediately after the text taken from the cited source

Using

parentheses:

... antibiotic-resistant bacteria (1).

square brackets:

... antibiotic-resistant bacteria [2].

superscript:

... antibiotic-resistant bacteria^{2}

We can cite multiple references at a time:

consecutive numbers

... antibiotic-resistant bacteria (1-3, 5-8).

non-consecutive numbers

... antibiotic-resistant bacteria (1, 3, 5).

Vancouver style for references

describe here:

- https://www.nlm.nih.gov/bsd/uniform_requirements.html

Thank you!