

Standing on the right shoulders

Literature review, sources of information and critical appraisal of a dental publication

Practical Class 9 · Social Medicine with Medical Ethics · Dental Medicine (English) · 2026/2027

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From a research question to the evidence that already exists

By the end of the class you should be able to

1. distinguish narrative, scoping and systematic reviews and meta-analysis;
2. choose the right database and use MeSH terms;
3. build and document a Boolean search in PubMed;
4. recognise the reporting guideline and appraisal tool for a given design;
5. spot a predatory journal;
6. know the optional individual critical-appraisal task.

Running example

Question: in adults receiving dental implants, are smokers more likely than non-smokers to lose the implant?

We will search for it live in PubMed and end with a published meta-analysis that answers it (Chrcanovic et al., 2015).

A review is research on research: it has a question, a method, data and limitations — exactly like a primary study.

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- 1. Why review — and which kind**
2. Sources of information
3. Building a search strategy
4. Reading a paper critically
5. Optional individual task

What a literature review is for

A **literature review** is a structured account of what is already known about a question: which studies exist, what designs they used, what they found, how trustworthy they are and **where the gap lies**.

It serves to:

- justify the research question (is it still open?);
- borrow validated definitions, instruments and case definitions (e.g. DMFT, periodontitis case definitions);
- anticipate confounders and sources of bias;
- estimate the expected effect or prevalence for the sample-size calculation;
- interpret the new results against the existing evidence.

Research waste is an ethical issue

A new study needs a defensible contribution beyond the existing evidence — a new population, longer follow-up, harms, a better design. Repeating a question that is already answered exposes participants to burden and risk without new knowledge.

Medical research involving human participants must ... avoid research waste. The research must conform to generally accepted scientific principles, be based on a thorough knowledge of the scientific literature ...

— WMA Declaration of Helsinki, 2024 revision, “Scientific Requirements and Research Protocols”

Types of review: how much method, how much synthesis?

Type	What it does	Strength	Main limitation
Narrative (traditional) review	Expert summary of a topic; selection of studies usually not specified	orientation, context, theory	selective citation; not reproducible
Scoping review	Maps the volume, nature and gaps of the literature on a broad question	systematic search on broad topics	usually no appraisal of quality; no pooled effect
Systematic review	Answers a focused question with a predefined, reproducible search, selection, appraisal and synthesis	minimises bias; transparent	only as good as the included studies
Meta-analysis	A statistical method , not a separate review type: pooling of effect estimates within a systematic review (a systematic review may have none)	precise overall estimate; explores heterogeneity	“garbage in, garbage out”; misleading if studies are too different
Umbrella review (overview)	Systematic review of systematic reviews	summarises a whole field	inherits the limits of the reviews
Rapid review	Systematic review with simplified steps to meet a deadline	timely for policy	higher risk of missed studies

Grant & Booth, Health Info Libr J 2009;26:91–108, doi:10.1111/j.1471-1842.2009.00848.x — typology of 14 review types

Scoping review or systematic review?

Scoping review — Arksey & O'Malley (2005)

1. identify the research question;
2. identify relevant studies;
3. select studies;
4. chart the data;
5. collate, summarise and report the results;
6. *(optional)* consult stakeholders.

Example question: “What has been published on oral HPV in dental settings, with which designs and outcomes?”

Systematic review — when to choose it (Munn et al., 2018)

- a **focused clinical question** (PICO/PECO) on effectiveness, harm, prognosis or accuracy;
- the answer should **inform practice or guidelines**;
- the included studies are **appraised** for risk of bias, and certainty is graded.

Example question: “In smokers vs non-smokers, how much higher is the risk of dental implant failure?”

A scoping review asks “what is out there?”; a systematic review asks “what is the answer, and how sure are we?”

A dental systematic review with meta-analysis: fluoride varnish

Marinho et al., Cochrane Database Syst Rev 2013

— fluoride varnish vs placebo or no treatment in children and adolescents.

- **Search:** Cochrane Oral Health Group Trials Register, CENTRAL, MEDLINE, EMBASE, CINAHL, LILACS/BBO, dissertations, conference proceedings; no language or date restrictions.
- **Included:** 22 randomised or quasi-randomised trials, 12,455 children randomised.
- **Outcome:** caries increment (D(M)FS, d(e/m)fs), mostly at about 3 years.

Result	Estimate
Prevented fraction, permanent teeth (13 trials)	43% (95% CI 30–57%)
Heterogeneity	$I^2 = 75\%$ (substantial)
Prevented fraction, primary teeth (10 trials)	37% (95% CI 24–51%)
Certainty of evidence	moderate

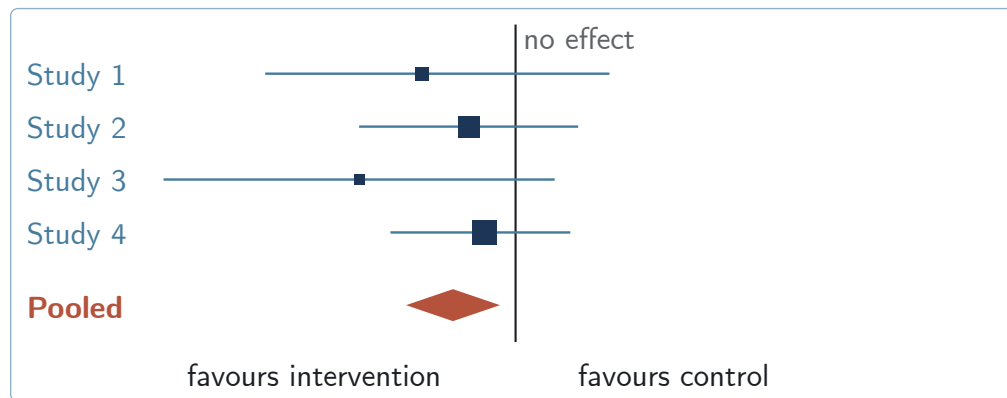
Prevented fraction = (mean caries increment in controls – mean increment with varnish) / mean increment in controls × 100 — a reduction in the **mean increment**, not in the proportion of children who develop caries.

How a systematic review is done — and how to read a forest plot

Workflow (reported with a PRISMA 2020 flow diagram)

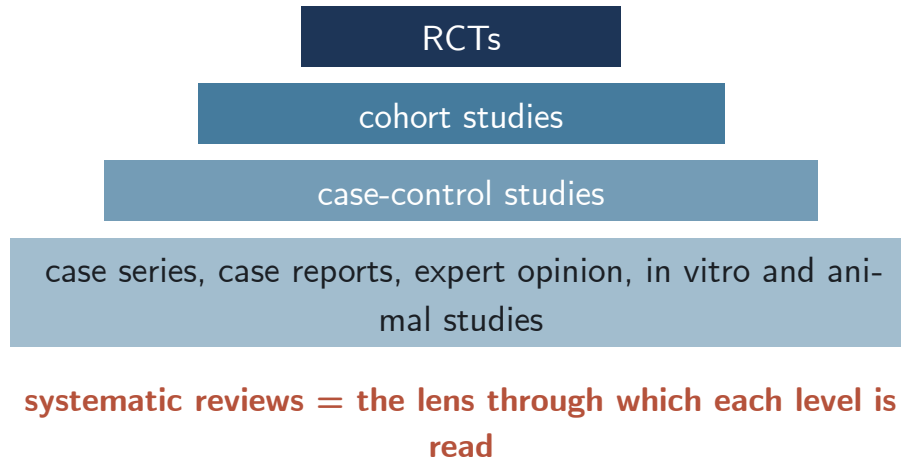
1. protocol with eligibility criteria, registered in advance (e.g. PROSPERO);
2. search of several databases and registers, documented line by line;
3. removal of duplicates;
4. screening of titles/abstracts, then full texts — two reviewers independently;
5. data extraction and risk-of-bias assessment;
6. synthesis (narrative and/or meta-analysis) and grading of certainty (GRADE).

The flow diagram counts **records** (database entries), **reports** (full texts) and **studies** separately.



Square = one study's estimate (size = weight); line = its 95% CI; vertical line = no effect; diamond = pooled estimate and its CI. The pooled CI is uncertainty about the **average** effect — heterogeneity (I^2) tells you how much the studies differ.

The evidence pyramid — and why it is not rigid



The “new evidence pyramid” (Murad et al., 2016):

- the borders between levels are **wavy**: the certainty of a body of evidence can be rated **down** (risk of bias, inconsistency, indirectness, imprecision, publication bias) or **up** (large effect, dose–response) — the GRADE approach;
- systematic reviews are **removed from the top** and become a lens for reading the other designs.

Consequence

A poorly conducted RCT is not automatically better evidence than a large, well-designed cohort study.

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Where the evidence lives

Source	Content and key feature	Access
PubMed	NLM search interface, over 41 million records (01.11.2026); its largest component, MEDLINE , is indexed with MeSH ; PubMed Central (PMC) is a separate free full-text archive	free
Cochrane Library	Cochrane systematic reviews and CENTRAL trials register; Cochrane Oral Health produces dental reviews	abstracts and plain-language summaries free
Embase (Elsevier)	biomedical and pharmacological; strong European coverage; Emtree thesaurus	subscription; depends on institution
Scopus (Elsevier)	multidisciplinary abstract and citation database; author profiles, citation tracking	MU-Plovdiv licence
Web of Science (Clarivate)	citation indexes; source of the Journal Impact Factor (Journal Citation Reports)	MU-Plovdiv licence
Dentistry & Oral Sciences Source (EBSCO)	specialised dental database, more than 230 journals plus monographs	MU-Plovdiv licence
Google Scholar	very broad, includes grey literature; opaque ranking, no controlled vocabulary, about 1,000 results shown, not reproducible	free

For a dental clinical question start with PubMed; a systematic search uses several databases chosen for the topic.

MeSH: searching for concepts, not words

MeSH (Medical Subject Headings) — the controlled, hierarchical vocabulary of the U.S. National Library of Medicine. Each MEDLINE record is indexed with headings that describe its content, whatever words the authors chose (since 2022 mainly automated, with human curation).

- one concept = one heading: “tooth decay”, “dental decay”, “caries lesions” → **Dental Caries**;
- a MeSH search includes the narrower terms below it in the tree (**explosion**);
- **subheadings** narrow the aspect, e.g. Dental Caries/prevention & control;
- **automatic term mapping** in PubMed translates plain words to MeSH — check it under “Details”; quotation marks, truncation and field tags switch it off.

Useful dental MeSH headings

Dental Caries · DMF Index · Fluorides, Topical · Periodontitis · Periodontal Index · Dental Implants · Dental Restoration Failure · Peri-Implantitis · Papillomavirus Infections · Oropharyngeal Neoplasms · Dental Anxiety · Oral Health

Trap

The newest records are not yet indexed with MeSH. Always combine the MeSH heading with free-text synonyms searched in title/abstract.

The MU-Plovdiv Library and Information Centre

- over **180,000** library items in print and electronic form;
- Central Library (15A Vasil Aprilov Blvd) and **3 specialised branches**;
- **440 seats**, of which 75 computer workstations;
- a team of 16 specialists who help with information retrieval and digital literacy.

Remote access from home

Licensed resources through EZproxy, with the personal username and password issued by the Library and Information Centre: login.ezproxy.mu-plovdiv.bg

Licensed resources most relevant to dentistry

- **EBSCO Discovery Service** — one search box for all licensed and open-access resources;
- **Dentistry & Oral Sciences Source** (EBSCO);
- **MEDLINE Ultimate** (EBSCO) — biomedical journals, many in full text;
- **Scopus** and **Web of Science**;
- **ScienceDirect** (Elsevier), **Springer** journals, **Oxford University** journals;
- e-books (e.g. AccessMedicine).

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From PECO to search blocks

Element	Concept	Block of synonyms (joined with OR)
P — population	dental implants	MeSH Dental Implants · “dental implant*” · “oral implant*”
E — exposure	smoking	MeSH Smoking · smok* · tobacco · cigarette*
C — comparison	non-smokers	usually not searched (implicit)
O — outcome	implant failure	MeSH Dental Restoration Failure · fail* · “implant loss” · survival

Logic

(P₁ OR P₂ OR ...) AND (E₁ OR E₂ OR ...)
optionally **AND (O₁ OR O₂ OR ...)**

OR widens within a concept; AND narrows across concepts.
Adding the outcome block trades sensitivity for precision.

Common errors

- joining synonyms with AND (results disappear);
- searching the comparison or vague outcome words;
- relying on one spelling (British/American: anaesthesia/anaesthesia).

Operators and tools in PubMed

Tool	Example	Effect
AND	implant AND smoking	both concepts must be present — narrows
OR	smoking OR tobacco	either term — widens; used for synonyms
NOT	caries NOT root caries	excludes records — use sparingly, can remove relevant studies
Truncation	smok*	smoke, smoker, smokers, smoking ...
Phrase	"implant loss"	the phrase — if it is in PubMed's phrase index; check Details and warnings
Field tags	[tiab] [mh] [pt]	title/abstract · MeSH heading · publication type
Parentheses	(A OR B) AND C	controls the order of operations
Filters	Systematic Review (= systematic[sb]), date, language	applied last; report them in the methods

A search is part of the method: write it down exactly, with the date and the number of hits, so that someone else can repeat it.

Live demo: smoking and dental implant failure in PubMed

#	Query (PubMed, 01.11.2026)	Hits
1	"Dental Implants"[MeSH]	34,426
2	"Dental Implants"[MeSH] OR "dental implant*"[tiab] OR "oral implant*"[tiab]	49,186
3	"Smoking"[MeSH] OR smok*[tiab] OR tobacco[tiab]	502,927
4	#2 AND #3	1,485
5	#4 AND ("Dental Restoration Failure"[MeSH] OR fail*[tiab] OR "implant loss"[tiab] OR survival[tiab])	863
6	#5 AND (systematic review[pt] OR meta-analysis[pt])	44
6a	#4 AND (systematic review[pt] OR meta-analysis[pt]) — without the outcome block	88
—	naive search dental implant smoking (for comparison)	1,552

What we found

In both lines 6 and 6a: Chrcanovic, Albrektsson & Wennerberg, **J Dent** 2015 — 107 studies; crude totals: **6.35% of implants** failed in smokers (1,259/19,836) vs **3.18%** in non-smokers (1,923/60,464).

Read the numbers critically

Counts change with every database update. Crude pooled totals are not the study-weighted meta-analytic estimate, and implants are clustered within patients. The authors warn of **uncontrolled confounding**.

Chrcanovic BR et al. J Dent 2015;43:487–498, doi:10.1016/j.jdent.2015.03.003

Your turn: search for fluoride varnish and caries in children

Question: in children and adolescents, does fluoride varnish, compared with no varnish, reduce caries increment?

In pairs (7 min):

1. write the PICO and decide which elements to search;
2. list 2–4 synonyms per concept and find the MeSH headings (MeSH database or “Details”);
3. combine the blocks in PubMed with OR/AND, using Advanced → History;
4. add the Systematic Review filter;
5. record each line, the date and the number of hits.

Report back (3 min)

- How many hits did each line give?
- Did the Cochrane review on fluoride varnish (Marinho et al., 2013) appear in your final set?
- Why do two pairs get different numbers for “the same” question?

Hint

Look for the MeSH headings **Fluorides, Topical**, **Dental Caries**, **DMF Index**, **Child**. Truncate where endings vary: varnish*, child*, adolescen*.

Reference managers and documenting the search

Tool	Licence and notes
Zotero	free, open source; browser connector; word-processor plug-in
Mendeley	free (Elsevier); PDF annotation
EndNote	commercial (Clarivate)
JabRef	free, open source; works with BibTeX

Export from PubMed (Send to → Citation manager, .nbib) or by DOI; let the tool format the reference list in **Vancouver** style.

What to record for every search

- database and interface (e.g. PubMed);
- date of the search;
- the full search string, line by line;
- number of hits per line and filters used;
- how duplicates were removed and records screened.

Keep the DOI of every paper you cite — it is the permanent link to the article (<https://doi.org/...>).

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Reporting guidelines: what a good paper must tell you

Guideline	Design	Reference
CONSORT 2025	randomised trials	Hopewell S et al. BMJ 2025;389:e081123, doi:10.1136/bmj-2024-081123
STROBE	cohort, case-control, cross-sectional	von Elm E et al. Lancet 2007;370:1453–1457, doi:10.1016/S0140-6736(07)61602-X
PRISMA 2020	systematic reviews, meta-analyses	Page MJ et al. BMJ 2021;372:n71, doi:10.1136/bmj.n71
STARD 2015	diagnostic accuracy studies	Bossuyt PM et al. BMJ 2015;351:h5527, doi:10.1136/bmj.h5527
COREQ · SRQR	qualitative research	Tong A et al. Int J Qual Health Care 2007;19:349–357, doi:10.1093/intqhc/mzm042 · O'Brien BC et al. Acad Med 2014;89:1245–1251, doi:10.1097/ACM.0000000000000388
ARRIVE 2.0	animal research	Percie du Sert N et al. PLoS Biol 2020;18:e3000410, doi:10.1371/journal.pbio.3000410
CRIS	in vitro studies in dentistry	Krithikadatta J et al. J Conserv Dent 2014;17:301–304, doi:10.4103/0972-0707.136338

All are collected by the EQUATOR Network (equator-network.org). A guideline is a checklist for reporting — not a quality score. “Not reported” is not the same as “not done”; older papers pre-date current guidelines.

Critical appraisal tools by design

Tool	Used for	What it judges
CASP checklists	RCTs, cohort, case-control, qualitative, systematic reviews ...	validity, results, local applicability — short question lists, free online (casp-uk.net)
JB1 checklists	most designs incl. prevalence and qualitative studies	methodological quality, item by item
RoB 2	randomised trials	randomisation, deviations from intended interventions, missing outcome data, outcome measurement, selection of the reported result
ROBINS-I	non-randomised studies of interventions (ROBINS-E: of exposures, e.g. smoking)	risk of bias against a hypothetical “target” randomised trial (confounding, selection, classification ...)
AMSTAR 2	systematic reviews of healthcare interventions	16 items, e.g. protocol, comprehensive search, risk-of-bias assessment; overall confidence rating, not a summed score
GRADE	a body of evidence for one outcome	certainty: high · moderate · low · very low

Sterne JAC et al. BMJ 2019;366:l4898, doi:10.1136/bmj.l4898 · Sterne JAC et al. BMJ 2016;355:i4919, doi:10.1136/bmj.i4919 · Shea BJ et al. BMJ 2017;358:j4008, doi:10.1136/bmj.j4008

Three questions behind every checklist

1 · Are the results valid?

- clear, focused question (PICO/PECO)?
- appropriate design for the question?
- how were participants selected — and who was lost?
- randomisation and allocation concealment; blinding of assessors?
- were confounders measured and adjusted for?
- unit of analysis: patients, teeth, surfaces or implants — was clustering taken into account?

2 · What are the results?

- size of the effect: RR, OR, HR, mean difference, prevented fraction;
- precision: the **95% confidence interval**;
- statistical vs **clinical** significance;
- are the conclusions supported by the data — or overstated?

3 · Will they help my patients?

- are the participants and setting like mine?
- were all important outcomes (incl. harms) considered?
- benefits vs harms and costs;
- funding and conflicts of interest declared?

A p-value measures how compatible the data are with the null hypothesis and its assumptions; read it together with the effect estimate and its confidence interval.

Worked appraisal: does periodontal treatment prevent preterm birth?

Michalowicz et al., N Engl J Med 2006 (OPT trial)

Element	OPT trial
P	pregnant women with periodontitis, 13–17 weeks of gestation
I	scaling and root planing before 21 weeks + monthly polishing, oral hygiene instruction (n = 413)
C	the same treatment after delivery (n = 410)
O	gestational age at end of pregnancy (primary); birth weight, small for gestational age
Design	randomised controlled trial, registered (NCT00066131)

Results

- periodontal measures improved ($P < 0.001$);
- preterm birth (< 37 weeks): **12.0%** (49/407) vs **12.8%** (52/405);
- hazard ratio **0.93** (95% CI **0.63–1.37**), $P = 0.70$;
- birth weight 3,239 g vs 3,258 g; no safety concerns.

Appraisal questions

- Is the CI narrow enough to exclude a clinically important benefit?
- Was treatment early enough? Were both arms similar at baseline?
- Why did observational studies suggest an association?

Michalowicz BS et al. N Engl J Med 2006;355:1885–1894, doi:10.1056/NEJMoa062249

Association is not effect

Observational evidence

Women with periodontitis had more preterm births. But periodontitis shares risk factors with preterm birth — smoking, socioeconomic disadvantage, infections — that can **confound** the association.

Experimental evidence

Randomisation balances known **and unknown** prognostic factors **in expectation** (chance imbalances can remain). The OPT trial asked whether **this treatment, at this time** changes the outcome — and did not demonstrate a reduction in preterm birth. That does not prove periodontitis has no causal role.

A contrasting trial: Tonetti et al., N Engl J Med 2007

120 patients with severe periodontitis. Intensive treatment **worsened** endothelial function 24 hours after treatment (acute inflammation), but flow-mediated dilatation was **better** than in controls at 60 days (difference 0.9 percentage points) and 180 days (2.0 points, 95% CI 1.2–2.8). Endothelial function is a **surrogate** outcome: the trial does not show fewer cardiovascular events.

Tonetti MS et al. N Engl J Med 2007;356:911–920, doi:10.1056/NEJMoa063186

Predatory journals: publication without scholarship

Predatory journals and publishers are entities that prioritize self-interest at the expense of scholarship and are characterized by false or misleading information, deviation from best editorial and publication practices, a lack of transparency, and/or the use of aggressive and indiscriminate solicitation practices.

— Grudniewicz A et al. *Nature* 2019;576:210–212, doi:10.1038/d41586-019-03759-y

Warning signs

- flattering e-mail invitations to submit, often outside your field;
- promise of “peer review” within days; fees revealed late;
- fake or unverifiable impact factors and indexing claims;
- editorial board that cannot be verified; no clear retraction policy.

How to check

- **Think. Check. Submit.** checklist (thinkchecksubmit.org);
- is the journal in **DOAJ** (open access) or in MEDLINE, Scopus or Web of Science?
- does the publisher belong to COPE and state its peer-review process?
- indexing and badges help verification but do not prove methodological quality.

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Optional task: critical analysis of a dental publication

Optional — not compulsory, not graded.

Students who want practice and feedback appraise **one** published study in dental medicine and writes a structured critical analysis of **at most 1,000 words** (two A4 pages), using the template in the handout.

- choose a paper from the shortlist **or** propose your own (original study or systematic review, indexed, with a DOI), approved by the teacher in advance;
- identify the design and use the matching checklist (CASP or JBI);
- give your own judgement, supported by the text of the paper.

Shortlist (full references and DOIs in the handout)

Paper	Design
Gillison 2012, JAMA — oral HPV prevalence	cross-sectional
Eke 2012, J Dent Res — periodontitis in US adults	cross-sectional
D'Souza 2007, NEJM — HPV and oropharyngeal cancer	case-control
Poulton 2002, Lancet — childhood SES, adult oral health	cohort
Michalowicz 2006, NEJM — periodontal therapy, preterm birth	RCT
Tonetti 2007, NEJM — periodontal therapy, endothelium	RCT
Cohen 2000, Br Dent J — dental anxiety in daily life	qualitative
Chrcanovic 2015, J Dent — smoking and implant failure	SR + MA
Marinho 2013, Cochrane — fluoride varnish	SR + MA
Walsh 2019, Cochrane — fluoride toothpastes	SR + network MA

Structure of the critical analysis (one-page template)

#	Section	What to write
1	Reference	full reference in Vancouver style, with DOI
2	Question	research question in a design-appropriate framework: PICO (intervention), PECO (exposure), population–condition–context (prevalence), PICo (qualitative); the authors' aim and hypothesis, if stated
3	Design and methods	study type (justify it), setting, participants and sampling, sample size, exposure/intervention, outcome and how it was measured
4	Main results	the key estimate with its 95% CI (prevalence, OR, RR, HR, mean difference, prevented fraction) or main themes for qualitative studies
5	Validity	design-specific checklist (CASP / JBI): e.g. sampling frame and non-response (prevalence); allocation concealment, blinding, missing outcomes (RCT); recruitment, reflexivity, credibility (qualitative); search, selection, synthesis (review)
6	Reporting and integrity	matching reporting guideline (STROBE, CONSORT, PRISMA, COREQ...); registration, ethics approval, funding, conflicts of interest
7	Applicability	are the results relevant to patients in Bulgaria? what would change in practice or dental public health?
8	Conclusion	your overall judgement in 2–3 sentences: how far can the authors' conclusions be trusted?

Feedback criteria (20 points, not a grade)

Criterion	Points
Question framed with a design-appropriate framework	2
Design correctly identified and justified; appropriate checklist	3
Methods described accurately (participants, sampling, measurement)	2
Main results reported with effect size and 95% CI (or themes)	3
Validity: design-specific sources of bias discussed with examples from the paper	5
Reporting guideline, ethics, funding and conflicts of interest	2
Applicability and own reasoned conclusion	2
Structure, academic English, Vancouver reference with DOI	1
Total	20

Scores well

An argued judgement that quotes the paper's own numbers and limitations.

Scores poorly

A paraphrase of the abstract; "the study was good"; claims without page or table references.

Handing it in and academic integrity

Optional, no deadline

- hand it in whenever you are ready during the semester; you get written feedback;
- format: PDF, at most 1,000 words (two A4 pages, 11-pt font), file name surname-group-appraisal.pdf;
- give it to the teacher in class or by e-mail;
- attach the completed checklist (CASP or JBI) as an appendix — it does not count towards the page limit;
- a paper not on the shortlist must be approved **before** you start.

Academic integrity

- the analysis and judgement must be **your own work**;
- language-editing tools, including AI, may be used **only** to improve the English — not to generate the appraisal;
- quotations from the paper are marked and referenced;
- you may be asked to explain your analysis orally.

Take-home messages

1. A literature review is research with a method; a **systematic** review makes that method explicit and reproducible.
2. Start with PubMed and add databases chosen for the topic; combine **MeSH** headings with free-text synonyms in title/abstract.
3. Synonyms are joined with **OR**, concepts with **AND**; record every line, the date and the number of hits.
4. Check reporting against the right guideline (CONSORT, STROBE, PRISMA ...) and appraise validity with the right tool (CASP, JBI, RoB 2, AMSTAR 2).
5. Judge the **size and precision** of an effect, not only the p-value; “not demonstrated” is not “disproved” — and association is not effect.
6. Avoid predatory journals: as a reader and as an author.

Optional: choose a paper and try the critical analysis — feedback, no grade.

Sources

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- Tonetti MS, D'Aiuto F, Nibali L, et al. Treatment of periodontitis and endothelial function. *N Engl J Med* 2007;356:911–920. doi:10.1056/NEJMoa063186
- World Medical Association. Declaration of Helsinki: ethical principles for medical research involving human participants. *JAMA* 2025;333:71–74. doi:10.1001/jama.2024.21972
- Reporting guidelines (CONSORT 2025, STROBE, PRISMA 2020, STARD 2015, COREQ, SRQR, ARRIVE 2.0, CRIS): full references on the reporting-guidelines slide.
- MU-Plovdiv Library and Information Centre, mu-plovdiv.bg (accessed 01.11.2026). PubMed searches run on 01.11.2026.

Questions?