

Literature Searches and AI in Health Libraries

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Introduction

AI and libraries?



**Nope, that's
an Aye-Aye:
shouldn't
really be in
libraries**

What do we mean by AI?



OECD definition: AI system:

An AI system is a **machine-based system** that, for explicit or implicit objectives, **infers, from the input it receives, how to generate outputs** such as predictions, content, recommendations, or decisions that can influence physical or virtual environments.

Different AI systems vary in their levels of autonomy and adaptiveness after deployment.

Intleacht shaorga & Seachtain na Gaeilge

English

Artificial intelligence

Chatbot

Generative AI

Machine learning

Search strategy

Systematic review

Hospital/medical librarian

Gaeilge

Intleacht shaorga (IS)

Bota comhrá

IS ghiniúnach

Meaisínfhoghlaim

Straitéis chuardaigh

Athbhreithniú córasach

Leabharlannaí ospidéal/leighis

AI for literature searches: questions



- Should **we** use AI ourselves for these processes in literature searches (an information retrieval question)?
- Can we advise our **researcher colleagues/library users** to use AI for searching (an information literacy question)?
- Are we equipped to **train** library users on the pitfalls and **fix** any problems with their prompts and results?
- Can we stand over this as a software/process for use in literature searches with regard to **academic integrity** and **data security**?

Literature review process

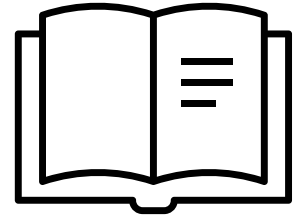
1. Generation of review ideas
2. Scoping searches
3. Comprehensive literature searches
4. Screening of search results
5. Quality assessment
6. Data extraction
7. Synthesis and write-up

Scoping searches

AI for scoping searches

Do we want:

- General/high-level concepts about a given topic?
- A set of relevant papers to read?
- Search terms for a database search?



Suggestions for scoping tools

Play around with tools designed and based on scholarly research rather than those based only on the available bits of the general internet (paywalled material is unlikely to be accessible to many generative AI tools - so far)

Suggestions (not endorsements!) for tools to play with

Many bibliographic database platforms are building their own AI software to augment their search interfaces

Suggestions: Literature mapping tools



To find a set of relevant papers on a topic, try **literature mapping tools**. For example:

Connected papers

Elicit.AI

Litmaps

ResearchRabbit

Scite.AI

**Semantic Scholar/
Semantic Reader**

Suggestions: Research paper summaries

To create **summaries** of relevant papers, you could try inbuilt database AI tools or try these tools:



Corel.AI

Litmaps

Consensus

SciSpace/Typeset.io

ResearchRabbit

Scholarcy

AI for scoping searches: MeSH

Find MeSH terms with **PubReminer**

#	OR	Mesh		#	OR	Substances
2597	<input type="checkbox"/>	<u>Humans</u>	P	682	<input type="checkbox"/>	<u>Nicotine</u>
2365	<input type="checkbox"/>	<u>Electronic Nicotine Delivery Systems</u>	P	115	<input type="checkbox"/>	<u>Nicotinic Agonists</u>
2019	<input type="checkbox"/>	<u>Smoking Cessation</u>	P	91	<input type="checkbox"/>	<u>Flavoring Agents</u>
1702	<input type="checkbox"/>	<u>/ epidemiology.</u>	P	55	<input type="checkbox"/>	<u>Tobacco Smoke Pollution</u>
1300	<input type="checkbox"/>	<u>/ statistics & numerical data</u>	P	49	<input type="checkbox"/>	<u>Biomarkers</u>
1290	<input type="checkbox"/>	<u>/ psychology.</u>	P	41	<input type="checkbox"/>	<u>Varenicline</u>
1170	<input type="checkbox"/>	<u>/ adverse effects</u>	P	35	<input type="checkbox"/>	<u>Aerosols</u>

Generative AI: caveat indagator/trix

How about standalone AI chatbots **ChatGPT, CoPilot** or **Gemini** as scoping search tools?

Treat them like **supplementary search engines**

We don't know their contents, nor the algorithms used to capture relevant results, nor what biases are implicit in searches of their content.

They **can** capture some interesting and useful results
(which you **must** verify as they hallucinate)

Caveats to Generative AI for searching


Bias: May be riddled with bias depending on training. Many generative AI tools are trained on the random internet including social media

Copyright: May be trained on material sourced with no consideration for copyright, author's rights, privacy, or other library concerns

Data security: It's possible anything you input is used as training material and your data may be sold on – be careful with both your personal and work information. Chatbots may now also cause data breaches via worm attacks!

Environment: Worse on energy and water use than regular search

Free: If you're not paying, then you're the product



Search strategy creation: ChatGPT, Microsoft CoPilot, Google Gemini

Search strategy creation

Recent published articles and blogs have suggested Boolean search strategies can be created via prompts in generative AI chatbots. But:

1. Can ChatGPT suggest MeSH terms and keywords?
2. Can ChatGPT Boolean up these terms for me?
3. Will those search strategies run in Pubmed?
4. Can I trust the results?



So we had a look!

Search strategy creation: ChatGPT

ChatGPT 3.5: simple prompt

What are keywords and MeSH terms for the concept of vaping?

ChatGPT 3.5: Simple prompt: keywords

Vaping

E-liquid

Electronic cigarette

Nicotine vaping

E-cigarette

Vaping health effects

Vape

Vaping trends

Vaping devices

Vaping regulations

ChatGPT 3.5: Simple prompt: MeSH terms

- Electronic Nicotine Delivery Systems
- Electronic Cigarettes
- Nicotine
- Vaping-associated lung injury
- Vaping products
- Vaping cessation
- Vaping behavior
- Vaping marketing
- Vaping policy
- Vaping-related disorders

(Pink text=real MeSH term)

ChatGPT 3.5: Slightly complex prompt

Please construct a search strategy using MeSH terms, keywords, Boolean operators and PubMed syntax for the following question: what benefits and harms are associated with the use of e-cigarette devices in an adult population

ChatGPT 3.5: keywords

e-cigarettes

adverse effects

vaping

side effects

electronic nicotine

health outcomes

delivery systems

safety

benefits

efficacy

harms

adult population

ChatGPT 3.5 results: MeSH terms

- Electronic Cigarettes (**NOT a MeSH term**)
- Smoking Cessation (MeSH term)
- Tobacco Use Cessation Devices (MeSH term)
- Harm Reduction (MeSH term)
- Risk Assessment (MeSH term)

ChatGPT 3.5 Pubmed syntax

(**Electronic Cigarettes**[Mesh] OR vaping[Title/Abstract] OR "electronic nicotine delivery systems"[Title/Abstract])

AND (Smoking Cessation[Mesh] OR "Tobacco Use Cessation Devices"[Mesh] OR "Harm Reduction"[Mesh] OR "Risk Assessment"[Mesh])

AND (Benefits[Title/Abstract] OR Harms[Title/Abstract] OR "adverse effects"[Title/Abstract] OR "side effects"[Title/Abstract] OR "health outcomes"[Title/Abstract] OR safety[Title/Abstract] OR efficacy[Title/Abstract])

AND ("Adult"[Mesh])

ChatGPT 3.5 note

Note from ChatGPT 3.5

“This search strategy combines MeSH terms with keywords related to e-cigarettes, smoking cessation, harm reduction, and risk assessment.

It also includes terms related to benefits, harms, and outcomes associated with e-cigarette use in the adult population.

Adjust the strategy as needed based on the specific focus of your search or any additional relevant terms you identify during the process.”



Search strategy creation: Microsoft CoPilot

MS CoPilot: Slightly complex prompt

Please construct a search strategy using MeSH terms, keywords, Boolean operators and PubMed syntax for the following question: what benefits and harms are associated with the use of e-cigarette devices in an adult population


MS CoPilot: prompt style

Choose a conversation style

More
Creative

More
Balanced

More
Precise

 Your personal and company data are protected in this chat

Please construct a search strategy using MeSH terms, keywords, Boolean operators and PubMed syntax for the following question: what benefits and harms are associated with the use of e-cigarette devices in an adult population|



224/2000



MS CoPilot: MeSH terms

“Certainly! Let’s create a comprehensive search strategy for your question on the benefits and harms of e-cigarette use in adults. We’ll use MeSH terms, keywords, Boolean operators, and PubMed syntax.”

MeSH Terms:

- **Electronic Cigarettes**: This is the main MeSH term for e-cigarette devices.
- **Smoking Cessation**: Relevant to benefits, as e-cigarettes are often considered as an alternative for quitting smoking.
- **Adverse Effects**: Relevant to harms associated with e-cigarette use.
- **Adult**: To specify the population of interest.

MS CoPilot: Keywords

Keywords:

- **E-cigarette** (or synonyms like “electronic nicotine delivery systems,” “ENDS,” or “vaping”).
- **Benefits** (or synonyms like “advantages,” “positive effects,” or “pros”).
- **Harms** (or synonyms like “risks,” “adverse effects,” or “negative consequences”).

MS CoPilot: Boolean operators

Boolean Operators:

- Combine the MeSH terms and keywords using Boolean operators:
 - **AND**: To narrow down the search results.
 - **OR**: To include synonyms or related terms.

MS CoPilot: Pubmed syntax

PubMed Syntax: Construct the search query using the MeSH terms and keywords:

```
("Electronic Cigarettes"[MeSH] OR "E-cigarette" OR "Electronic Nicotine Delivery Systems" OR "ENDS" OR "Vaping") AND  
("Smoking Cessation"[MeSH] OR "Benefits" OR "Advantages" OR  
"Positive Effects" OR "Pros") AND  
("Adverse Effects"[MeSH] OR "Harms" OR "Risks" OR "Negative Consequences")  
AND "Adult"[MeSH]
```

Search strategy creation: Google Gemini

Google Gemini: Slightly complex prompt

Please construct a search strategy using MeSH terms, keywords, Boolean operators and PubMed syntax for the following question: what benefits and harms are associated with the use of e-cigarette devices in an adult population

Google Gemini: MeSH terms

MeSH terms:

- Electronic Cigarettes/ (Mesh)
- Nicotine/ (Mesh)
- Adult/ (Mesh)
- Risk Factors/ (Mesh)
- Benefits/ (Mesh)
- Harm/ (Mesh)
- Smoking Cessation/ (Mesh)

Keywords:

- e-cigarette* OR vaping
- adult*
- benefit* OR harm* OR risk*
- cessation OR quit*

Google Gemini: search syntax

Search syntax:

(Electronic Cigarettes[Mesh] OR e-cigarette* OR vaping)

AND Adult[Mesh]

AND (Benefit*[Mesh] OR Harm*[Mesh] OR Risk Factors[Mesh])

AND (Smoking Cessation[Mesh] OR quit*)

Google Gemini:

“Explanation:

This search uses both MeSH terms and keywords to capture relevant articles.

The search is limited to the adult population using the "Adult" MeSH term.

It retrieves articles discussing both benefits and harms by including "Benefit*" and "Harm*" MeSH terms along with "Risk Factors" and the keyword "quit*".

The final step refines the search to articles focusing on smoking cessation using the "Smoking Cessation" MeSH term and the keyword "quit*".

Note: This is a starting point, and you may need to modify it based on your specific needs and the results you find. You can also use additional filters in PubMed to refine your search further, such as publication date or language.”

Brief evaluation

Differences in search blocks

Microsoft CoPilot:

E-cigarettes AND Advantages AND Disadvantages AND Adult

ChatGPT:

E-cigarettes AND Smoking cessation/harm reduction/risk assessment AND Benefits/harms AND Adult

Google Gemini:

E-cigarettes AND Adult AND benefit/harm AND smoking cessation

Differences in syntax

Microsoft CoPilot: ("Electronic Cigarettes"[MeSH] OR "E-cigarette" OR "Electronic Nicotine Delivery Systems" OR "ENDS" OR "Vaping")

ChatGPT: (Electronic Cigarettes[Mesh] OR vaping[Title/Abstract] OR "electronic nicotine delivery systems"[Title/Abstract])

Google Gemini: (Electronic Cigarettes[Mesh] OR e-cigarette* OR vaping)

Differences in MeSH terms selected

Gemini	Copilot	ChatGPT
Electronic Cigarettes[Mesh]	"Electronic Cigarettes"[MeSH]	Electronic Cigarettes[Mesh]
Smoking Cessation[Mesh]	("Smoking Cessation"[MeSH]	Smoking Cessation[Mesh]
Nicotine/ (Mesh)		"Tobacco Use Cessation Devices"[Mesh]
Risk Factors/ (Mesh)		Risk Assessment (MeSH term)
Adult/ (Mesh)	Adult	
Benefits/ (Mesh)		
Harm/ (Mesh)	Adverse Effects	Harm Reduction (MeSH term)

Differences between searches: MeSH

The chatbots **hallucinate/invent** similar and different MeSH terms – a big issue, especially as it's not hard to find correct MeSH terms oneself.

Electronic Cigarettes[MeSH] is not a MeSH term!

ChatGPT came up with the MeSH terms 'Electronic Nicotine Delivery Systems' for the initial simple prompt but not for the more complex prompt

Differences: limiting syntax

Use (or not) of inverted commas with (supposed) MeSH terms, e.g.:

Microsoft Copilot used “Electronic Cigarettes”[Mesh] n=0

but Google Gemini used Electronic Cigarettes[Mesh] n=8,453

(no inverted commas meant automatic term mapping to “Electronic Nicotine Delivery Systems” gave n=8,453; you mightn’t know your chatbot hallucinated a MeSH term if you get some results rather than zero)

MS CoPilot: MeSH term fail

The screenshot shows a search interface with a search bar containing the text "electronic cigarettes"[MeSH]. To the right of the search bar is a blue "Search" button and a close icon (X). Below the search bar are links for "Advanced", "Create alert", and "Create RSS", and a "User Guide" link on the right. Below these links are two dropdown menus: "Sort by: Best match" and "Display options" with a gear icon. The main content area displays the message "No results were found." followed by two yellow warning boxes. The first warning box contains a warning icon and the text "Your search was processed without automatic term mapping because it retrieved zero results." The second warning box contains a warning icon and the text "The following term was ignored: electronic cigarettes".

Further differences between searches

Inconsistency between suggested MeSH terms and those used:

Gemini suggested **Nicotine/ MeSH** as a MeSH term but did not include it in the suggested strategy; ChatGPT didn't suggest **Adult** as a MeSH term but included it in the suggested strategy.

Inclusion of 'title/abstract' **field tags** in ChatGPT, not in Gemini or CoPilot

All have used 'some' **Boolean** syntax

Unreplicable searches: ChatGPT

Replicating the search in ChatGPT on 5th Mar gave a different search!

("Electronic Nicotine Delivery Systems" [MeSH] OR "e-cigarette" OR "electronic cigarette" OR "vaping") AND

("Health Benefits" [MeSH] OR "benefits" OR "advantages" OR "positive effects") AND

("Risk Assessment" [MeSH] OR "harms" OR "risks" OR "negative effects") AND

("Adult" [MeSH] OR "adults" OR "grown-ups")

Unreplicable searches: CoPilot

Similarly, **replicating** the MS Copilot search on 5th Mar gave different results!

(E-cigarettes OR "Smoking, Electronic" OR Vaping) AND (Benefits OR Advantages OR "Positive effects" OR Pros) AND ("Adult population" OR Middle-aged OR Elderly)

(E-cigarettes OR "Smoking, Electronic" OR Vaping)

AND (Harms OR Risks OR "Negative effects" OR Cons OR "Adverse events" OR "Side effects" OR Safety OR "Health impact")

AND ("Adult population" OR Middle-aged OR Elderly)

Why didn't it work?

Chatbots are **prediction machines**. The result is a list of keywords and (maybe) MeSH terms that you still have to verify and add to, and some rudimentary Boolean links you'll have to edit.

(So far, they don't seem capable of estimating how a PICO translates to a search, what to include or exclude for optimal searching, how to test a search, how random the terminology in the underlying journal articles are, how much published material might be wrong, or what a useful result would look like – the librarian stuff)

Can we improve the results?

- **Rephrase the prompt** to optimise results (more detail & specificity)
- Try **different AI tools** to check any differences and theoretically reduce bias
- Use the **most up-to-date** version you or your organisation can afford
- Use the **paid versions** of any LLM – theoretically safer, and more up-to-date terms used
- Don't stick to **PICO**, the chatbot will try to include everything including outcomes

Chatbots for search suggestions

Chatbots might not be able to formulate great searches, but they MIGHT be able to **make suggestions** to your already-designed search.

Alaniz *et al.* 2023 sourced MeSH terms & keywords, then asked ChatGPT-4 to build on that with additional MeSH terms, keywords, & translated searches.

Some formatting issues and hallucinations occurred, but asking for suggestions to augment an existing search seemed safer and more helpful than creating a full search from scratch.

Things to note

Referencing your AI searches

Acknowledge any use of AI tools. Describe the details in the **Methods** section. It is useful to **quote the prompt** used and the results can go in an Appendix. The reference to the chatbot typically doesn't go in the Reference List but are noted in the text (like a personal communication).

Check COPE, ICJME and NLM guidance. The **human author** is responsible for all content and any mistakes the AI tool makes. "Authors should be able to assert that there is no **plagiarism** in their paper, including in text and images produced by the AI" (COPE, 2024)

Security settings

When using any of this software, don't forget to set your **privacy and security** settings to keep your data, the data of your colleagues and library users, and your organisations' network as safe as possible. Be aware that malware is possible with this software as with any software.

New worm can propagate through generative AI, researchers warn

by Leigh Mc Gowran

<https://www.siliconrepublic.com/enterprise/generative-ai-worm-morris-spam-emails> Mar2024

AI-generated research

“We need less research, better research, and research done for right reasons” (*Douglas Altman, 1994*)

The scholarly landscape is about to be flooded by a wave of LLM-generated studies: some will be good, some will be poor quality. If nothing changes to filter this, the next round of AI chatbots will have been trained on this material indexed in search engines and will generate more nonsense.

Convenience as a negative

- **Speeding up** the scoping, searching, screening and synthesising processes for reviews is not a bad thing per se,
- **But:** skimming papers isn't research synthesis, and literature searching isn't throwing a few search terms into a mystery box and hoping for magic
- **Research work** (including the literature searches) should include the opportunity for the individual human to fully engage with the literature, to learn, understand and share.

Conclusions

Can we use AI for search strategies?

The current general chatbots don't appear to be there yet regarding **search strategy construction**. They have some use in **suggesting keywords** but need verification. Published papers suggesting adequate search strategies are a prompt away are likely to mislead some non-library folk.

Generative AI search within existing structured databases is likely to operate on scholarly datasets and with more consideration to search methods.

We'll need to add AI literacy to our information literacy and lit search talks!

Are chatbot searches safe and effective?

- The results may not be **accurate** – generalisations and hallucinations
- The work to **edit and verify** is onerous and requires search skills
- The results from search prompts are not **replicable** – different search strategy results from the same prompts.
- The process is not **transparent** – unknown core texts, algorithms
- There is a lack of **validation work** so far to back up claims of effectiveness for anything more than very general scoping searches
- Be careful with your data and do not risk a **data breach** at your work

What's next?

Be optimistic without being naïve!

This technology is still developing and we are all learning. As librarians, we want to use this effectively and safely and we do love new tech!

Can we recommend it for searching?

The folk we work with will use it anyway, and aren't waiting for our advice. We'll help with AI literacy and literature search training talks, and we will aim to share knowledge and keep up with improvements in the field.

Further reading

Further reading (1)

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<https://web.archive.org/web/20240308092033/https://www.cilip.org.uk/page/AI> on 08/03/2024

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- COPE: Committee on Publication Ethics. Authorship and AI tools [Internet]. 2023. <https://publicationethics.org/cope-position-statements/ai-author>
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Further reading (5)

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- Najafali D, Camacho JM, Reiche E, et al. Truth or lies? The pitfalls and limitations of ChatGPT in systematic review creation. Aesthet Surg J 2023;43:NP654–5. <https://doi.org/10.1093/asj/sjad093>

Further reading (6)

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AI Tools to play with

These are the three 'chatbot' tools used to test searches (others are also available)!

ChatGPT <https://chat.openai.com/>

Google Gemini: <https://gemini.google.com/>

Microsoft CoPilot <https://copilot.microsoft.com/>

