The role of natural language processing to optimize SLRs for HTA – a successful AI pilot with NICE

MSR199

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Introduction to SLRs and NLPs

Systematic literature reviews (SLRs)

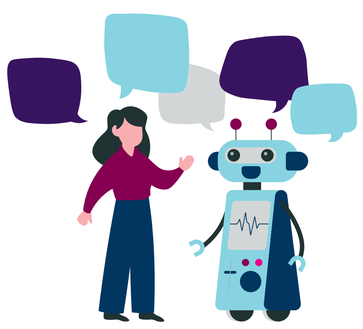
Routinely required for **health technology appraisal (HTA)** in many countries[1]

The growth rate of published clinical literature means that manual SLRs are **increasingly time-intensive**

Natural language processing (NLP)

Form of **artificial intelligence (AI)** that can reduce the burden of manual SLRs

Industry and HTA agencies should align on the appropriate way to use NLP for SLRs in the future



NLP-supported SLR pilot study

AIMS: **Improve efficiency** **Maintain accuracy and transparency**

Previous retrospective validation exercise (lung cancer setting)

Showcased robustness and precision compared with a fully manual SLR[2]

87% reduction in the number of documents selected for manual screening

All 38 unique studies from the manual SLR were still identified

AstraZeneca (AZ) interest to innovate

Aim to determine whether NLP meets the methodological requirements of HTA bodies

NICE (National Institute for Health and Care Excellence; UK HTA agency) chosen as a candidate

Novel pilot study with NICE (ovarian cancer setting)

Part of an HTA appraisal related to an indication based on the Phase III SOLO1 trial[3]

Methodology developed after discussion with NICE and thoroughly critiqued by the NICE Evidence Assessment Group (EAG)

Since our study, NICE have published guidance on using AI (including NLP) in evidence generation[4]

Jun 2023

Decision problem meeting

- NICE open to the pilot
- AZ commitment to the pilot

Jul

Aug

Submission to NICE

- SOLO1 Cancer Drugs Fund exit dossier
- NLP-supported SLR included

Sep

Clarification

- EAG minor data extraction query
- No criticism of the NLP approach

Oct

EAG report[5]

- Clinical SLR: 'the company's SLR was conducted to a good standard'
- Cost-effectiveness SLR: 'the EAG has no major concerns about the search strategies used'

Nov

Dec

Jan 2024

NICE committee meeting

- SLR and its methodology not raised for discussion

NLP capabilities for SLRs

NICE pilot process

Scope

Use search strings, inclusion/exclusion criteria and date restrictions defined by previous manual SLR

Search query creation

Search publications* for population, intervention or trial type of interest

Matched entity highlighting

Highlight key terms within publications, with colour-coding to indicate which search term they are matched against

Filter by year

Title and abstract screening

Single review process followed by a sample quality check (QC)

Full-text screening

Single review process followed by a sample QC

Manual step

NLP step†

*Search queries were executed on the MEDLINE and Insightmeme databases.

†The I2E application from Linguamatics (an IQVIA company) was used. This application uses NLP technology and allows creation of transparent rule-based or keyword search queries for information retrieval.

Future use of NLP in SLRs

Refining and reusing search queries

Identify words that only appear in irrelevant documents – update original query to omit them to:

- Reduce number of irrelevant hits
- Maintain perfect recall of relevant hits

Develop reusable smart queries to drive accuracy and efficiency within and across SLRs

Entity recognition

Identify important categories of words to accelerate the screening process

Information retrieval

Quickly navigate relevant content in the SLR database

Information extraction

Automatically extract details such as study design, population size, etc

Topic modelling

- Identify primary topics
- Cluster similar documents together
- Show how topics change over time
- Identify potential gaps

Summarization

Automate identification and display of key themes as a set of concise points

Conclusions

NLP-supported SLR methods and results validated by the NICE EAG and considered appropriate for HTA decision-making

This signals that HTA agencies may be willing to explore novel AI-based solutions to improve efficiency, particularly for tasks like SLRs, which:

- Are time-intensive and low-risk
- Retain human oversight

Additional NLP functionality to support SLRs can be explored, such as:

- Information extraction
- Topic modelling
- Summarization

There remains a need to collaborate with other global HTA agencies to develop broader consensus on using NLP-supported approaches

References

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