# AI-Powered Search Strategy Development and Optimization for Systematic Literature Reviews

MSR125

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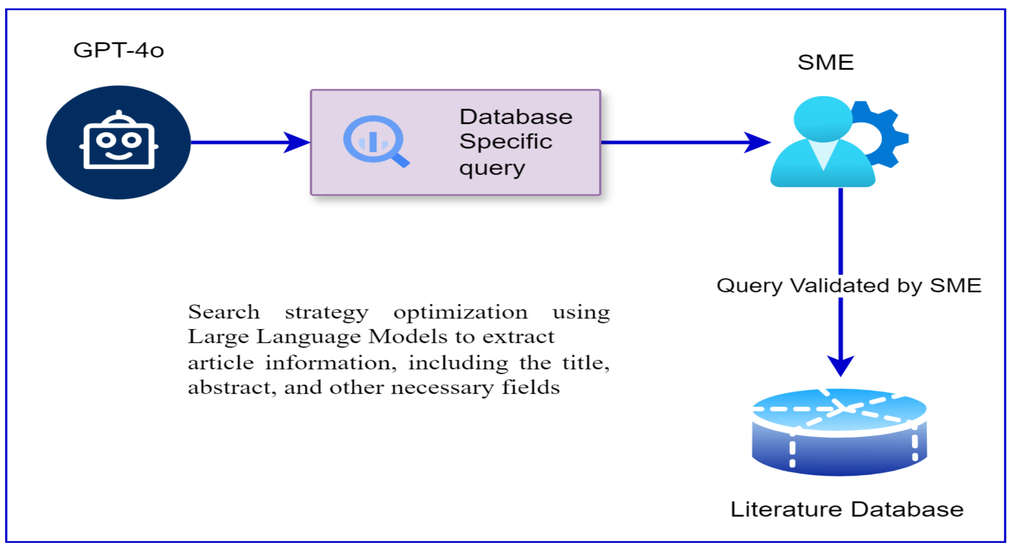
## CONCLUSION

The AI tool using GPT-4o considerably enhanced search query generation for SLRs in medical research, speeding up the process and improving the comprehensiveness of literature searches. This innovation provides a new step in evidence synthesis methodology and allows the transformation of traditional research processes through AI integration. The tool's ability to generate optimized search queries for literature databases expedites the systematic reviews, saving time and resources while maintaining the high quality of evidence-based research.

## INTRODUCTION

- Systematic literature reviews (SLRs) are critical for evidence synthesis and play a key role in Health Economics and Outcomes Research (HEOR)
- The development of search strategies for SLRs is inherently complex, and requires extensive domain expertise and significant time investment
- This study used state of the art AI technology to develop a tool that can understand complex medical concepts and generate optimized search strategies. This search strategy is used to extract the metadata from the literature database as shown in Figure 1

**Figure 1: Search strategy development for Literature databases**




## OBJECTIVE

SLRs are critical for synthesizing evidence in healthcare, social sciences, and other research fields. However, generating and optimizing search strategies for these reviews can be time-consuming and labor-intensive, requiring expert knowledge to ensure comprehensive and unbiased results. This research aimed to develop an innovative tool to generate search queries for SLRs using generative AI.

- Build an intelligent interface that generates optimized search queries using GPT-4o specifically for medical databases
- Develop a PICOS-based framework for structured query development

## METHODS

This AI-powered search strategy generator was developed and implemented using a multi-phase approach. The system was developed using Python 3.10 as the main programming language, GPT-4o for natural language processing, and Flask framework for web application development, as shown in Figure 2.

**The architecture consists of three main components:**

**User Interface Development:**

- A responsive web interface implementation using Flask
- Integration of structured data collection input fields into the PICOS framework
- Feature to select literature data source from multiple medical literature sources (such as PubMed, Embase, etc.)
- Real-time query preview and modification capabilities, as shown in Figure 3

**Literature Database-based Prompt Development:**

- A tailored prompt with expected search tags has been developed and passed on to LLM. Example: Search tags for PubMed are shown in Table 1

**Query Generation Engine**:

- Processing natural language as inputs with GPT-4o.
- Medical vocabulary mapping using standardized terminologies (MeSH, Emtree)
- Boolean logic optimization algorithms development
- Database-specific syntax rules and requirements integration

**Validation and Optimization Module:**

- Automatic syntax checking implementation
- Query performance prediction metrics development

**Table 1: Search Syntax Operators and Tags for Literature Database (PubMed)**

| Category | Operators/Tags | Examples |
|---|---|---|
| Boolean Operators | AND, OR, NOT, () | diabetes AND obesity• cancer OR neoplasm• fever NOT malaria• (heart OR cardiac) AND disease |
| Field Tags | [Title], [Title/Abstract], [Author], [Journal], [MeSH Terms], [Publication Type], [Affiliation] | cancer[Title]• diabetes[Title/Abstract]• Smith J[Author]• Nature[Journal]• Diabetes Mellitus[MeSH Terms]• Review[Publication Type]• Harvard[Affiliation] |
| Phrase and Proximity | "quotes", NEXT, NEAR/n | "lung cancer"• lung NEXT cancer• cancer NEAR/3 therapy |
| Truncation and Wildcards | *, ?, # | therap*• wom?n• colo#r |
| Date Limiters | [Date - Publication], [Date - Create], [Date - Completion] | 2023[Date - Publication]• 2023/01/01:2023/12/31[Date - Create]• 2023/01/01[Date - Completion] |

## RESULTS

- The tool was tested to generate the search query for the PubMed database for an SLR focused on chronic rhinosinusitis with nasal polyps
- A domain expert extensively examined and adjusted search queries generated by the tool
- The AI-powered searches were comparable to manually generated ones in terms of both comprehensiveness and efficiency
- The AI tool significantly reduced the time required to develop and refine the search strategy, allowing researchers to focus more on data analysis and interpretation
- The evaluation of the AI-powered search strategy generator showed performance improvements in developing systematic literature review searches
- AI-generated strategies proved comparable to manual searches

**Figure 2: System architecture of search strategy generation using Generative AI**

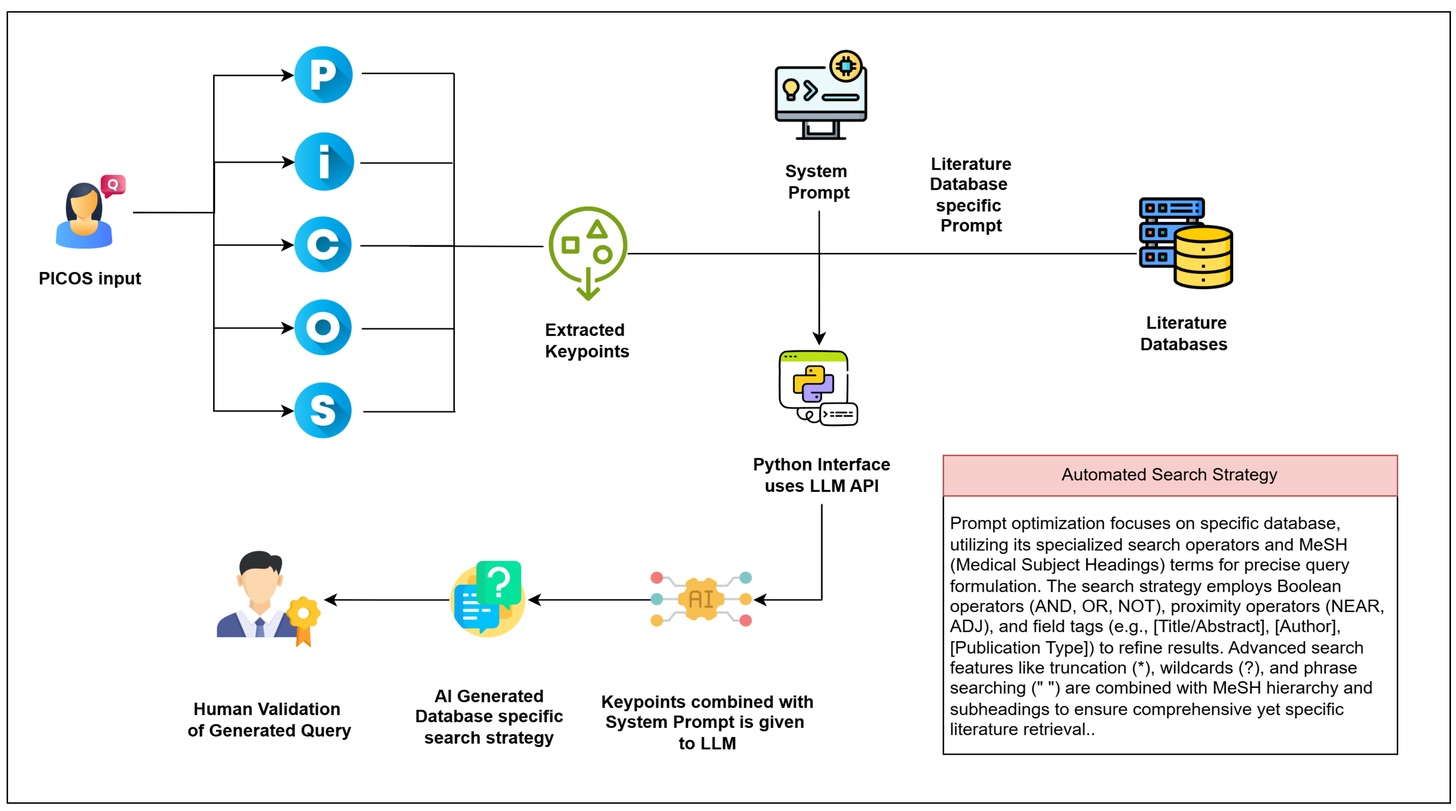
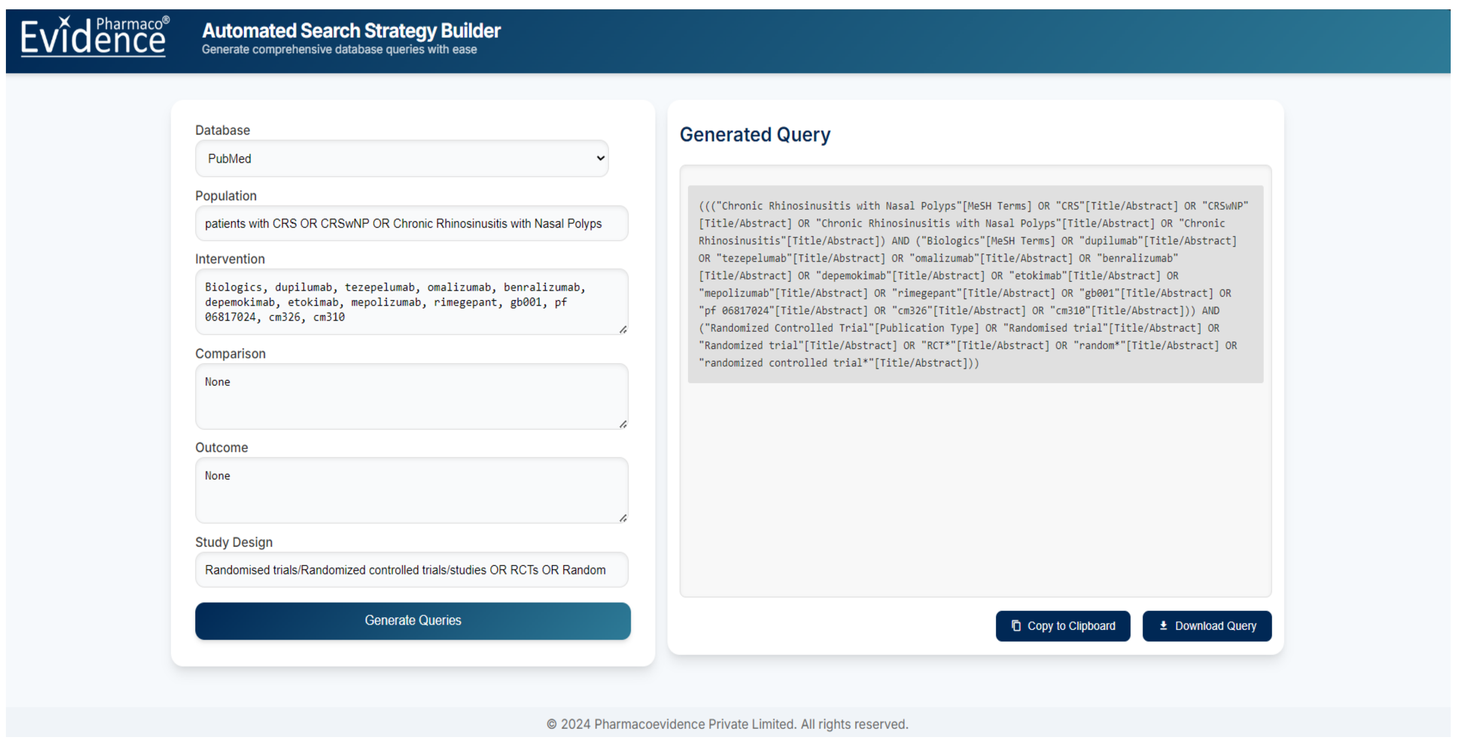



**Figure 3: Automated Search Strategy generation interface using Gen AI**



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## Disclosures

RK, BS, VS, and SA authors declare that they have no conflict of interest

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