

# Finding Answers to Complex Medical Questions

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# About Me

- ❑ Completed my PhD 2021
- ❑ University of Queensland, Australia
- ❑ Information Retrieval
  - Query refinement & understandability
  - Biomedical search



- ❑ Now: Leipzig University, Germany
- ❑ Host: webis/temir
- ❑ Information Retrieval + Natural Language Processing
  - Research at the intersection of these domains
  - Aligned with the goals of this project



A black and white photograph showing two surgeons from a low angle. They are wearing surgical caps and masks. In the background, there are multiple circular surgical lights mounted on a ceiling track system.

**How do clinicians  
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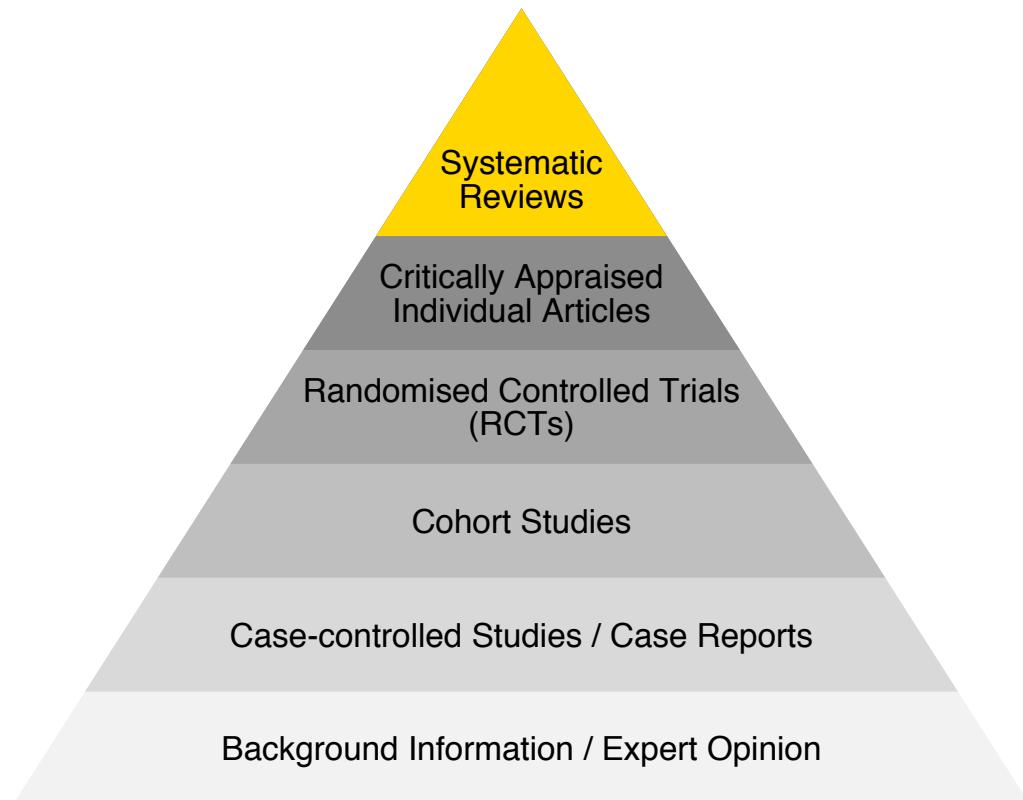
# **Systematic Reviews**

**How do governments  
and institutions make  
health policy decisions?**

# Systematic Reviews

## Overview

- **Guide** clinical decisions
- **Inform** practice and policy
- **Provide** evidence



# Systematic Reviews

## Costs and Feasibility

- **Money** → Can cost upwards of 250,000 Euros
- **Time** → Can take over a year

[McGowan and Sampson, 2005]

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**Should everyone wear a  
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- Level of uncertainty in the literature?
- Frequency of new studies is high?

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**In these cases, systematic reviews are not feasible**

# ALIVE: Automated Living Evidence

## Research Plan

Research addressing feasibility of systematic reviews

- Text classification [[Marshall and Wallace, 2019](#)]
- Study summarisation [[Wallace et al., 2021](#)]
- Guidelines for review automation tools [[O'Connor et al., 2019](#)]

# ALIVE: Automated Living Evidence

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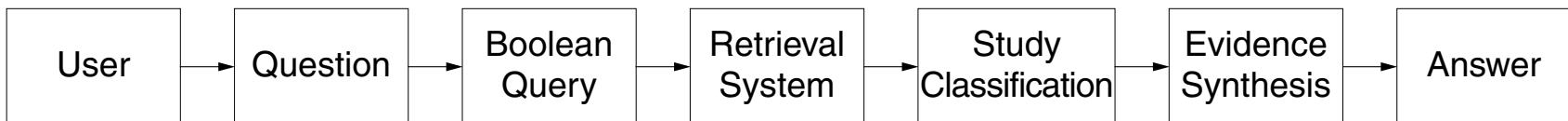
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I will take a **radically different approach** to current research

- Synthesising direct answers for complex medical questions

# ALIVE: Automated Living Evidence

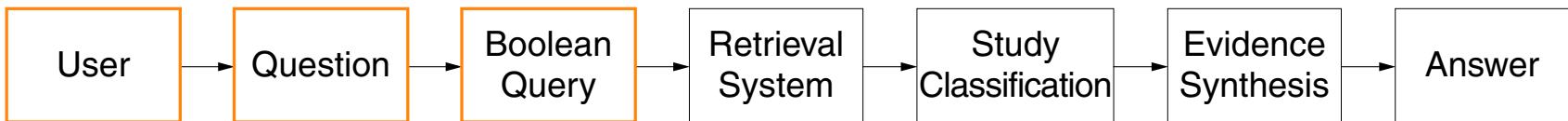
## Research Questions



- RQ1 How to extend Boolean query syntax to find more evidence for complex medical questions, and can queries be synthesized from questions?
- RQ2 How can advanced Boolean queries be used to classify evidence as relevant to complex medical questions?
- RQ3 How can the rapid pace at which medical studies are published be accounted for when evidence changes over time?
- RQ4 How can summaries be synthesized as evidence to answer complex medical questions, and what is their quality?

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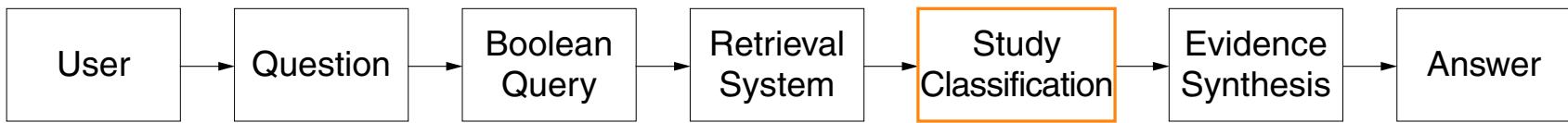
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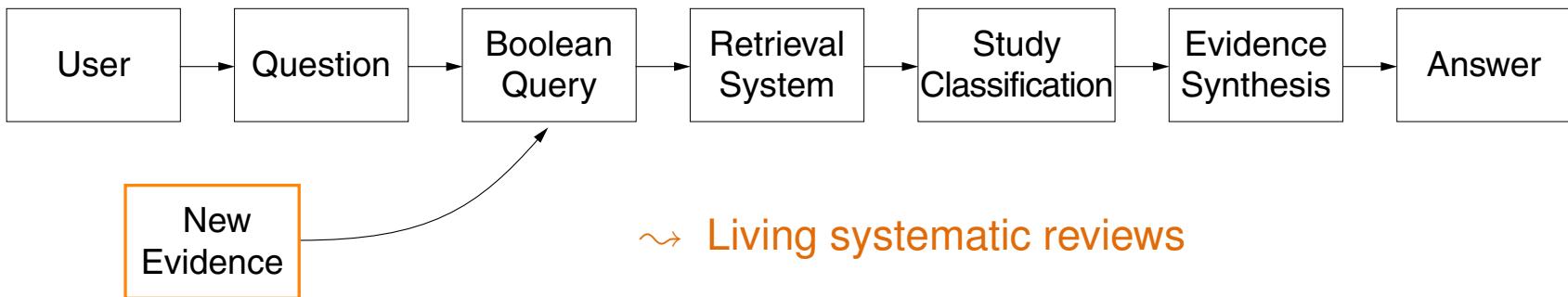
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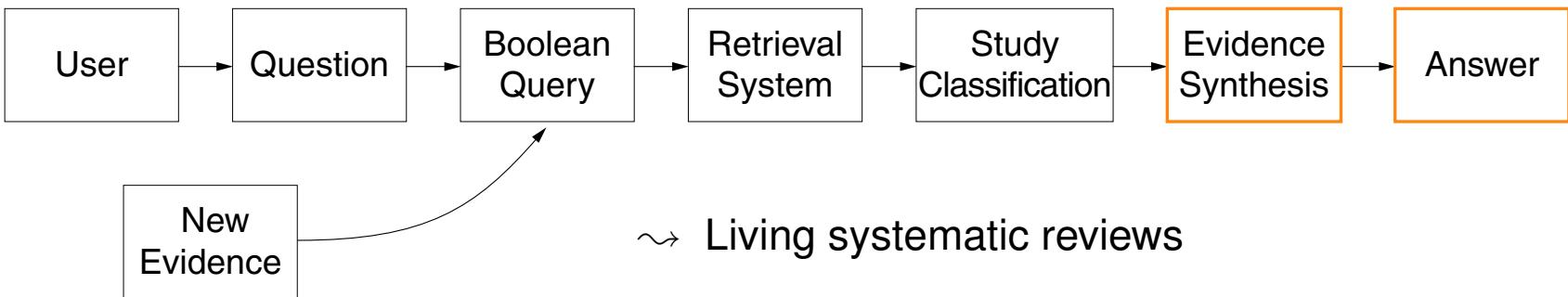


~> **Living systematic reviews**

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# ALIVE: Automated Living Evidence

## Envisioned System

alive Is hydroxychloroquine useful in treating people with COVID-19, or in preventing infection in people who have been exposed to the virus? Search

**Answer**

HCQ for people infected with COVID-19 has little or no effect on the risk of death and probably no effect on progression to mechanical ventilation. Adverse events are tripled compared to placebo, but very few serious adverse events were found. No further trials of hydroxychloroquine or chloroquine for treatment should be carried out.

These results make it less likely that the drug is effective in protecting people from infection, although this is not excluded entirely. It is probably sensible to complete trials examining prevention of infection, and ensure these are carried out to a high standard to provide unambiguous results.

[View statistical analysis](#)

**Confidence**

Confident about results for how many people died and moderately confident about how many needed mechanical ventilation. Moderately confident about the unwanted effects of hydroxychloroquine treatment, but less confident about results for serious unwanted effects; these results might change with further evidence.

[View study characteristics](#)

| Population   | Intervention   | Control   | Outcome  |
|--|--|---|--|
| <ul style="list-style-type: none"><li>• COVID-19</li><li>• Exposure to Covid-19</li><li>• Humans</li></ul> | <ul style="list-style-type: none"><li>• Hydrochloroquine</li><li>• Chloroquine</li></ul> | <ul style="list-style-type: none"><li>• Antiviral agent</li></ul> | <ul style="list-style-type: none"><li>• Time to clinical improvement</li><li>• Adverse event</li><li>• Hospitalisation</li><li>• Death</li></ul> |

**Search Results**

[Hydroxychloroquine in the treatment of COVID-19: a multicenter randomized controlled study](#)

[A randomized trial of hydroxychloroquine as postexposure prophylaxis for Covid-19.](#)

[Hydroxychloroquine with or without azithromycin in mild-to-moderate Covid-19.](#)

[Hydroxychloroquine for early treatment of adults with mild Covid-19: a randomized-controlled trial.](#)

[Efficacy of hydroxychloroquine in patients with COVID-19: results of a randomized clinical trial.](#)

[See all results](#)

**Study Flow Diagram**

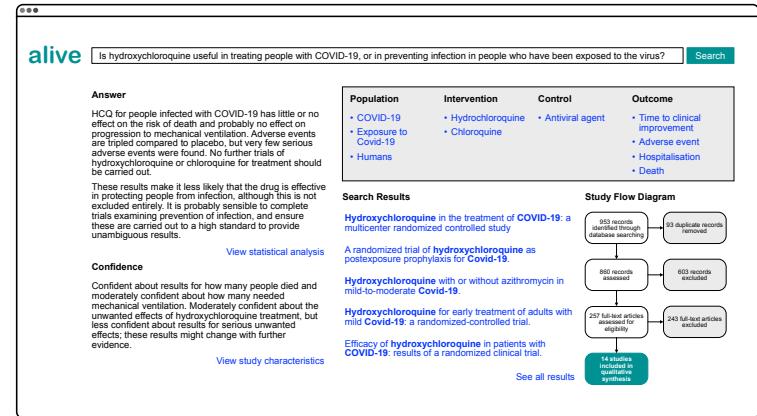
```
graph TD; A[953 records identified through database searching] --> B[93 duplicate records removed]; B --> C[860 records assessed]; C --> D[603 records excluded]; C --> E[257 full-text articles assessed for eligibility]; E --> F[243 full-text articles excluded]; E --> G[14 studies included in qualitative synthesis]
```

Example question and answers taken from the systematic review of [Singh et al.]

# Conclusion

## Next steps

- Develop tools to enable research  
Paper submitted and under review.
- Start research into RQ1  
Semantically enhanced Boolean queries.
- Reaching out to librarians  
Help inform and guide research.



## Envisioned outcomes

- Faster and less expensive systematic reviews
- Fully automated evidence synthesis
- Tools for librarians and researchers to automate evidence synthesis

## Stay in touch

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- scells.me
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