Text Mining for Clinical Decision Making in Healthcare

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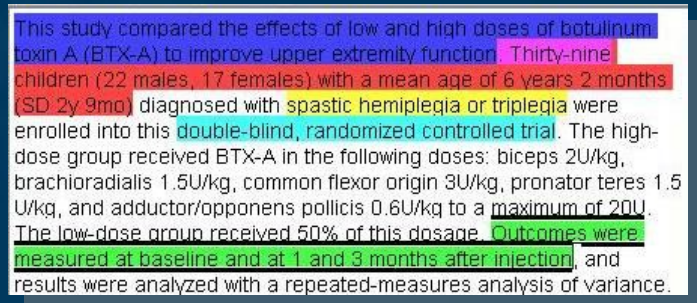


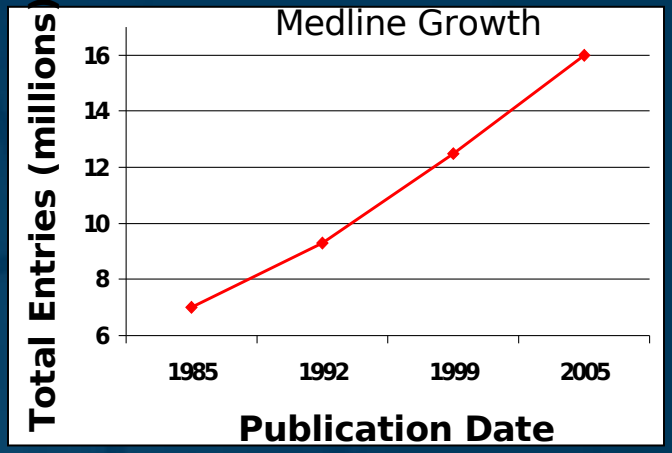
Evidence-Based Medicine (EBM)

- **"The use of current best evidence derived from research in making decisions about the care of individual patients."**
- ***When a clinical question arises at the point of care, the physician conducts a literature search, selects the best articles, evaluate/determine validity of research and decides what to do - while the patient is waiting in the exam room***
- **Evidence must be *applicable & appropriate* for the individual patient**
- **Without current best evidence, practice risks becoming rapidly out of date, to the detrimen of patients**

Sackett et al. Evidence based medicine: what it is and what it isn't. BMJ. 1996;312:71-72.

The Practice of EBM

- **EBM is greatly hampered by an *ever-expanding literature base* coupled with a limited amount of time and human mental capacity**

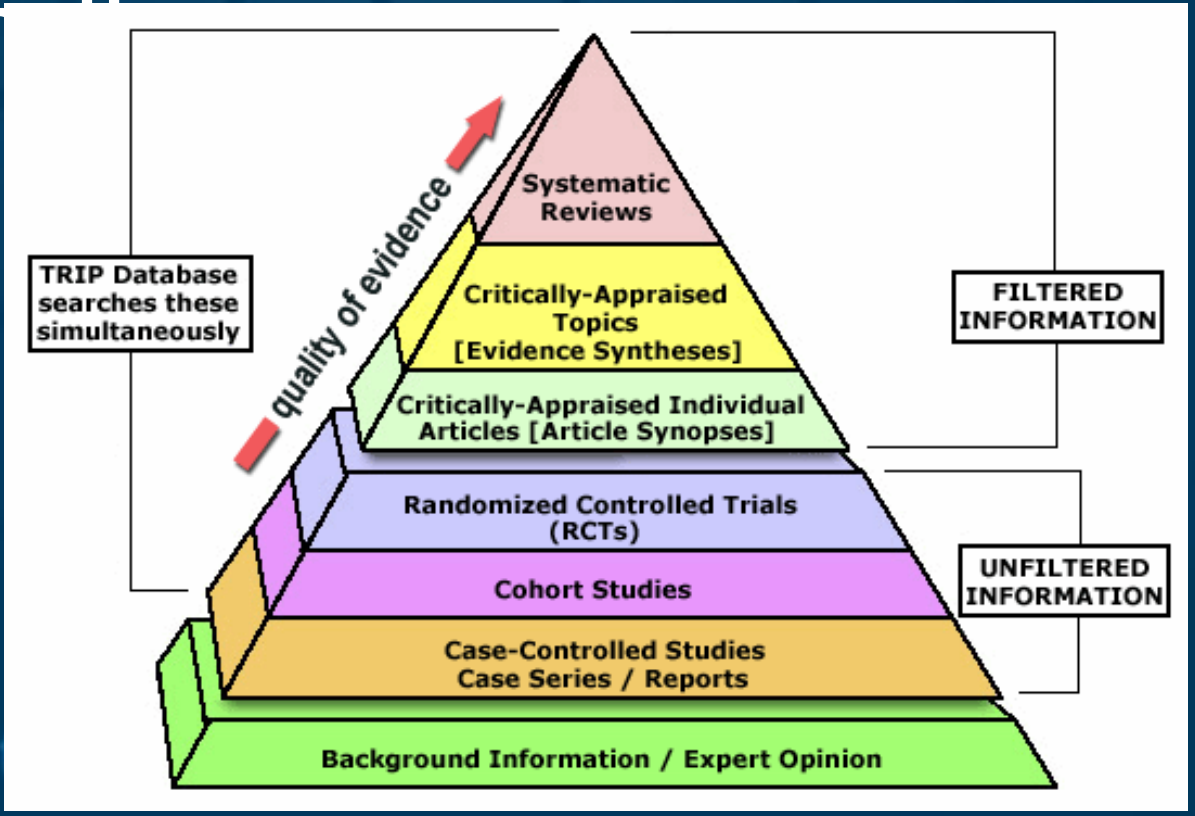


- Clinical questions arise 32% of the time, but physicians do not seek an answer 64 % of the time
- On average, physicians spend less than two minutes seeking an answer to a question
- Most common information sources:
  - fellow physicians, pharmacists and other individuals
  - drug references and textbooks

Ely et al. Analysis of questions asked by family doctors regarding patient care. BMJ. 1999;319:358-361.

Hierarchy of Evidence

- Most current evidence can be found in a hierarchy of information sources
- The *quality* of evidence available is graded in their ability to predict the effectiveness of the health pr



Systematic Reviews and Meta-Analyses

- Today, researchers & expert authors are providing secondary information for physicians
- **Systematic reviews:** high quality primary studies are identified, appraised and then summarized according to an explicit and reproducible methodology
- **Meta-analyses:** the results of multiple studies are analyzed together to provide improved guidelines for practice
- But even for expert readers/authors, it is increasingly challenging to keep up to date and analyze all studies

Information Sources for EBM

JOURNALS

- ACP Journal Club http://www.acpjc.org: Bimonthly journal summarizing over 100 clinical journals
- American Family Physician http://www.aafp.org/: Twice monthly clinical review journal

EVIDENCE SUMMARIES

- Clinical Evidence http://www.clinicalevidence.com: A compendium of systematic reviews
- The Cochrane Database of Systematic Reviews http://www.cochrane.org/: Systematic reviews

CLINICAL GUIDELINES

- Institute for Clinical Systems Improvement http://www.icsi.org/knowledge/: Guidelines for preventive services and disease management

How Can Language Technology Enrich and Facilitate the Practice of EBM?

- **Better tools are needed to help clinicians & researchers:**
  - Find information that is ***most relevant*** to the clinical problem at hand (based on condition and population characteristics)
  - Evaluate the implications of study results on the problem at hand (e.g. impact on patient care, quality of life, prognosis)
  - Evaluate the ***quality/reliability*** of information (factors include size of study, study methodology)
  - Assemble the information gathered for further assessment and decision making

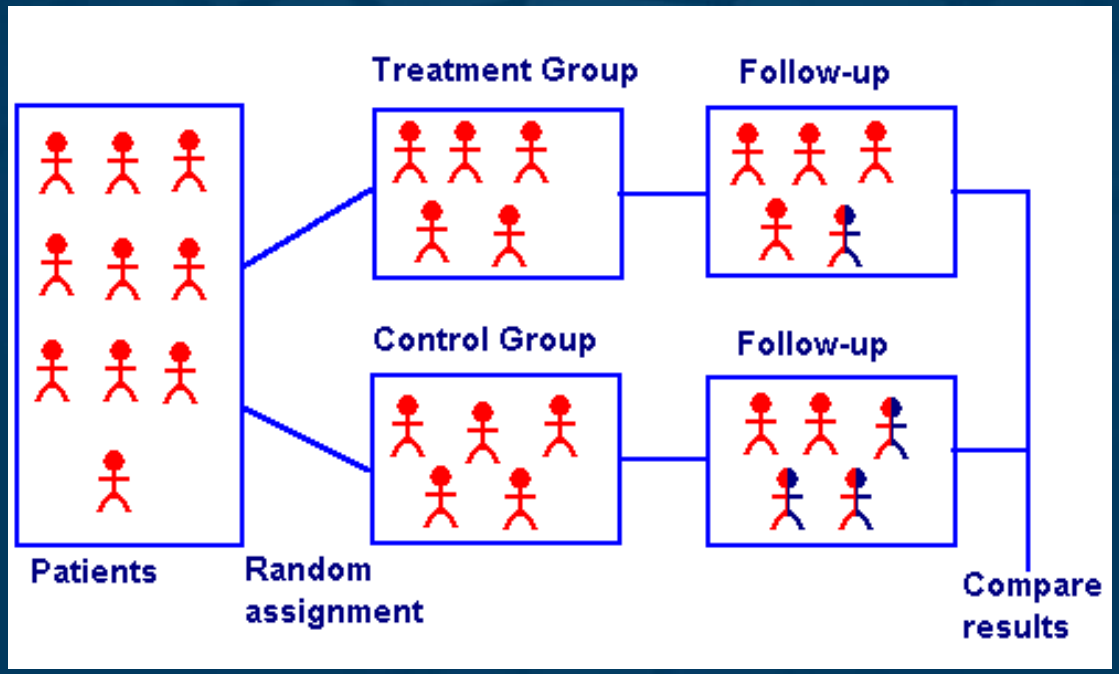
Language Technology at CHI

Our Goals:

- **Build applications that improve the quality of evidence used in decision making by:**
  - Enabling rapid and flexible access to biomedical information
  - Enhancing clinicians' and researchers' ability to integrate published scientific knowledge
- ***To extract the most critical information from biomedical literature (RCTs, case studies, systematic reviews etc) towards applications such as summarization, ultimately helping users to assess evidence***

Randomized Controlled Trials (RCTs)

- **Standard method of answering questions about the effectiveness of different therapies**

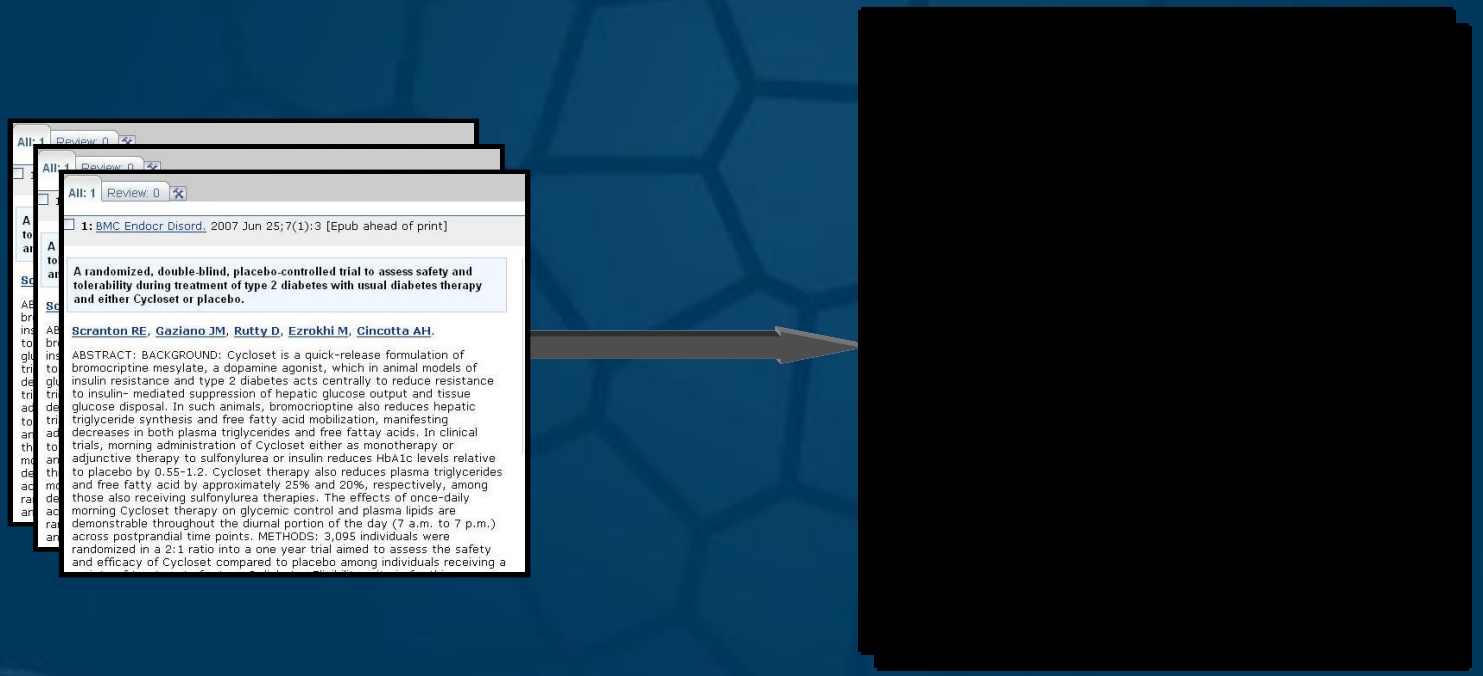


Critical Appraisal of RCTs

- **What information from an article is most applicable and appropriate for a physician practicing EBM?**
  - **Problem** - Is it a problem I see in my practice?
  - **Patient population** - Does the study's patient population look like my patient population?
  - **Intervention** - is the intervention realistic in my setting?
  - **Comparison** - What is the intervention being compared to?
  - **Outcomes** - Would the outcomes matter to my patients? How is this going to change the patient's overall prognosis and quality of life
  - **Number** - How many patients were in the study?
  - **Statistics** - How does the study present its findings?

Information Extraction

- Fine-grained extraction of parameters from RCT papers to help clinicians / researchers appraise the quality and relevance of each trial to the clinical question at hand

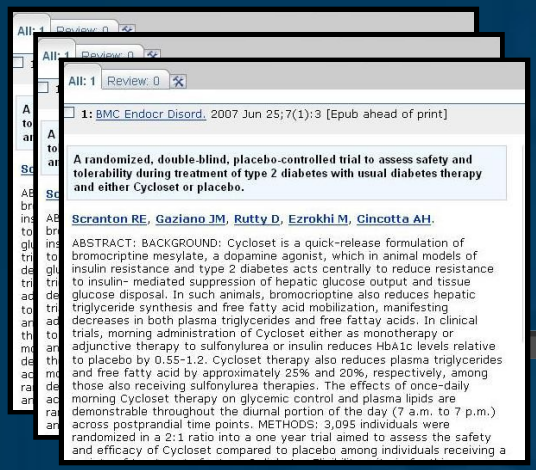


Semantic Analyses of Sentences in Clinical Abstracts

- **Linguistic analyses of structure of randomized clinical abstracts**
- **Semantic classification of sentences in clinical abstracts (Conditional Random Fields)**

Labels	Recall	Precision	*F*-score
	Accuracy = 87.6%		
AIM	0.99	0.95	0.97
METHOD	0.67	0.77	0.72
PARTICIPANT	0.90	0.77	0.83
RESULTS	0.91	0.92	0.92
CONCLUSION	0.90	0.97	0.93

Automatically Labeled Excerpts



AIM Aim of the study was to evaluate anti-ischemic, hemodynamic and neruohumoral effects of bimakaim, a novel selective K(+)-channel opener, in patients with stable angina pectoris and reproducible ST-segment depression ..

INTERVENTION Asthmatic children (6 - 12 years of age) were randomized to receive oseltamivir (2 mg/kg) or placebo twice daily, as a syrup ..

PARTICIPANTS Sixty healthy women, half of whom had been using OCs for at least the previous 6 months, participated in the study ..

Thank you!

http://www.chi.unsw.edu

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