



# Bell University Laboratories

## Answering Clinical Questions in Medicine

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### Bringing Evidence to the Point of Care

#### Purpose

- Answer clinical questions at the point of care, e.g. bedside.
- Questions may well already have been answered by published research, but finding the relevant information is difficult.
- Part of a larger project "Effective Delivery of Evidence to the Point of Care".

#### Requirements

- Use the best available information.
- Very high degree of accuracy in answers-- users can't sift through a lot of irrelevant information!

#### Solution

- Use evidence-based medical data sources, which appraise and summarize the available medical evidence.
- Knowledge-based question answering: to extract the most relevant information, questions are answered based on an understanding of the semantics of evidencebased medicine.



### Knowledge-Based Question Answering

#### Key Concepts: PICO

- Questions are answered based on the system's understanding of key concepts in evidence-based medicine: **P**atient population, **I**ntervention, **C**omparison, **O**utcome.

#### How are questions answered?

- Questions use the PICO concepts as categories. Their fields are filled with instances of these concepts.
- The *data sources* used are compendia and evaluations of the best available evidence about treatments, prognosis, diagnosis, etiology and prevalence.
- They are semi-structured (XML format).
- Documents are indexed, stored and retrieved using ToX.
- Answers are extracted from data sources by searching for the instances of the key concepts named in the question, in meaningful XML contexts.
- Contexts: Occurrences of key concepts are meaningful in some XML structures, not in others.
- Answer patterns: Combinations of contexts, one for each of P, I, C, O.
- An answer is found for a given answer pattern if each key concept occurs in context.

### Finding an Answer

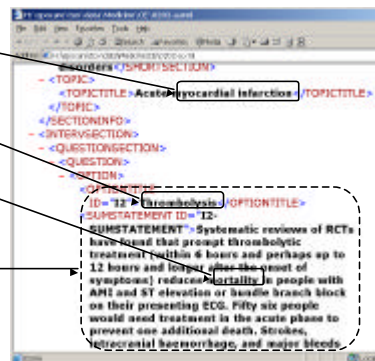
Patient population

Intervention

Outcome

An answer to the question:

P: myocardial infarction  
I: thrombolysis  
C: ---  
O: mortality



### Refinements through Computational Linguistics

#### Question can be described in a more natural way

- Keywordbased question:  
"myocardial infarction thrombolysis mortality"
- Natural language question:  
"In a (patient with suspected MI) p, does (thrombolysis) i (decrease the risk of death) o if it is administered 10 hours after the onset of chest pain?"

Given the natural language question, PICO information will be extracted automatically.

#### Answer can be refined by removing redundant information

- Short answer (the most concise answer): "Yes."
- Long answer (with justification, explanation or even contradictory results):  
Desired info: "...prompt thrombolytic treatment ... reduces mortality...".  
"The risk of stroke was increased by thrombolytic treatment ...".  
Redundant info: "Thrombolysis versus placebo reduced short term mortality...".  
"Reduced rates of death were seen..."