# The VeriClig Project: Extraction and Verification of Clinical Guidelines

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## Guidelines & Careflows

- ▷ Clinical guidelines are documents that describe the state-of-the-art on clinical therapies [2]
- ▷ They provide the basis for planning patient care in hospitals/clinics
- ▷ They are iteratively refined by experts:
  - evidence-based guidelines
  - clinical practice guidelines
  - careflows

## Problem(s)

Building a careflow from a clinical guideline is time consuming and error prone, due to complexity and ambiguity [5]

```
1.5.1.2.  consider metformin
as an option for first-line
glucose-lowering therapy for a
person who is not overweight.

1.5.1.3.  continue with
metformin if blood glucose
control remains inadequate and
another oral glucose-lowering
medication is added.
```

**Que (1):** Can NLP be used to automatically extract careflows?

**Que (2):** Can formal methods be used to ensure careflow quality?

## Project Goals

- ▷ Semantically annotate clinical guidelines and build careflows
  - evaluate annotation resources
  - propose techniques for extraction
- ▷ Check for their properties using formal methods/computational logic
- ▷ Evaluate the results by comparing to manually extracted guidelines

## Funding

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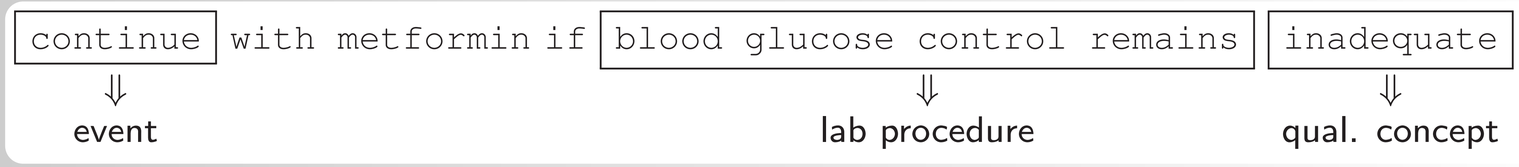
## Collaborations

Collborations are currently in course with the eHealth group from FBK-Irst (Trento, Italy), and the Merano hospital (Merano, Italy)

## Biomedical NLP Resources

Typically, biomedical thesauri have been exploited to semantically annotate guidelines [3], in particular the UMLS metathesaurus [1]




Such resources don't handle well guidelines, they

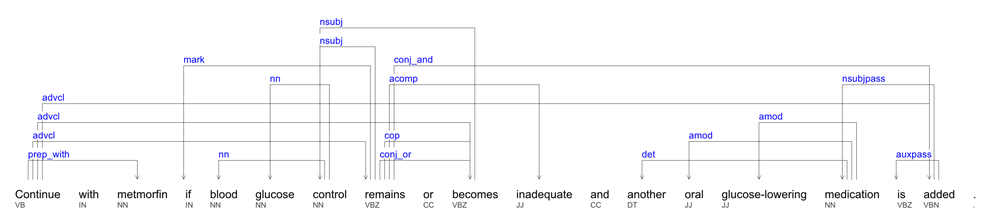
**(1)** don't segment well guidelines **(2)** ignore function words denoting structure

## Careflow Extraction and Verification

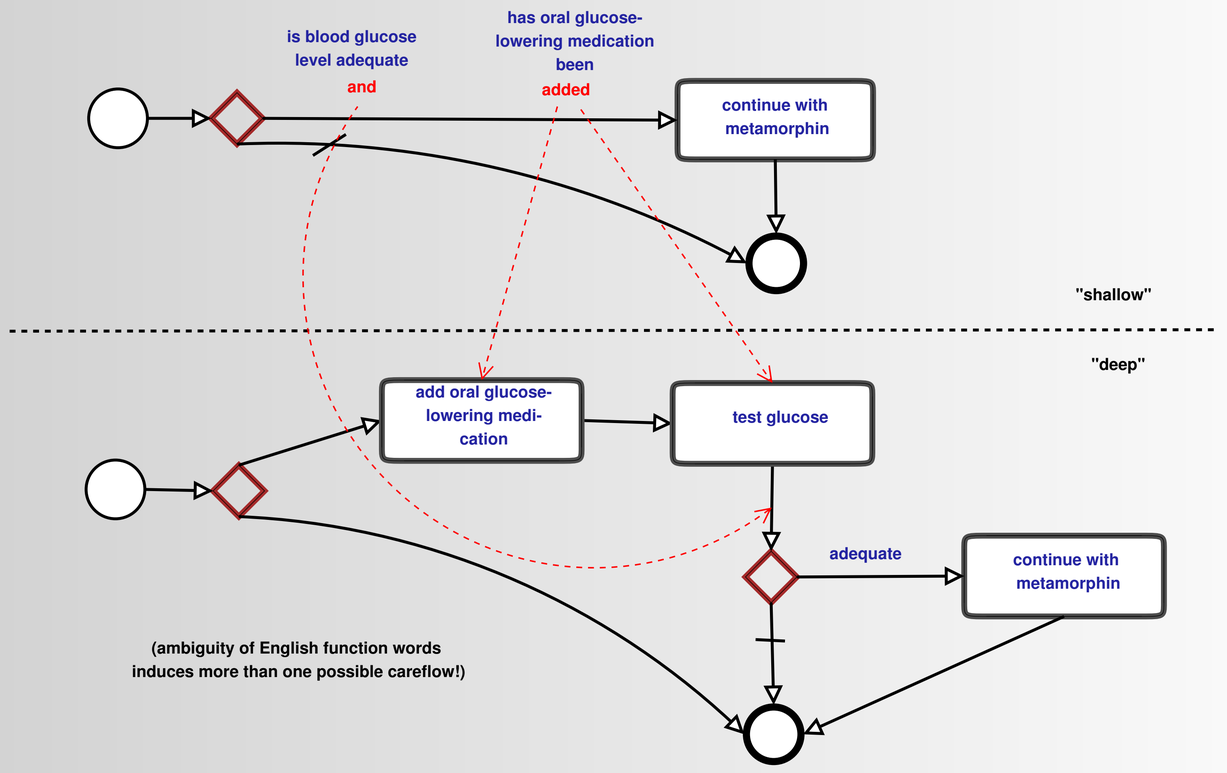
**But:** we can use NLP parsing, such as the Stanford dependency parser to

1. extract syntactic structure from guidelines
2. combine with UMLS or WordNet [4] annotations
3. use the parse trees to extract workflow structure

**e.g.** this dependency tree can be decorated with UMLS/WordNet tags




from parse tree and tags, careflows can be extracted ⇒
natural language ambiguity gives rise to several possibilities




- ▷ The workflow/careflow provides an explicit, but ambigous, (semi)formal representation of the control flow [2]
- ▷ It can be embedded in logics (FO, temporal) with reasoning services to:
  - ensure correctness of clinical properties
  - detect errors and flaws [2]

## References

[1] Alan R. Aronson and François-Michel Lang. And overview of MetaMap: Historical perspective and recent advances. *Journal of the American Medical Informatics Association*, 17(3):229–236, 2010.

[2] A. Bottrighi, F. Chesani, M. Montali, and P. Terenziani. Conformance checking of executed clinical guidelines in presence of basic medical knowledge. In *Proceedings of the 2011 Business Process Management Workshop*, 2012.

[3] Elena Cardillo, Luciano Serafini, and Andrea Tamilin. A lexical-ontological resource for consumer healthcare. In *Proceedings of 2nd ICST International Conference on eHealth (E-Health 2009)*, 2009.

[4] ed. Christiane Fellbaum. *WordNet: An Electronic Lexical Database*. MIT Press, 1998.

[5] National Institute for Health and Clinical Excellence. Type 2 diabetes. NICE clinical guideline 87, 2008.