

An Introduction to Modeling and Representation of Clinical Guidelines

Instructors

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Abstract

Clinical guidelines are potential tools for standardizing care in order to improve its quality and cost effectiveness. For guidelines to be delivered to the point of care through decision-support systems, they must be represented in a computer-interpretable format that enables machine inference. Since creating guidelines in such format is difficult, sharing the guideline specification across different institutions is vital. Many research groups have been working individually on developing modeling methods and computer-interpretable representations for clinical guidelines. Naturally, most of these efforts have been guided by local, application-specific considerations.

An invitational workshop on sharable guideline representations was held in Boston, March 3-4, 2000, hosted by InterMed (a collaboration of researchers at Stanford, Harvard, Columbia, and McGill), as well as the American College of Physicians-American Society of Internal Medicine. There, stakeholders from academia (from 8 different countries), government agencies, professional organizations, users, providers, and industry, all recognized the need for a standard sharable computer-interpretable guideline representation. One focus of the workshop and subsequent activities of a designated task force initiated at the workshop was to address and further define the functional requirements for such a standard representation of clinical guidelines. The proposed requirements encompass the entire life cycle of a computer-interpretable guideline: (1) authoring; (2) encoding; (3) reliability studies; (4) dissemination; (5) local adaptation and implementation; (6) testing; (7) use and maintenance; and (8) performance analysis. The instructors of this tutorial, who are members of the InterMed Collaboratory that developed the GuideLine Interchange Format (GLIF), will present the requirements for a sharable computer-interpretable guideline representation, and demonstrate them using GLIF.

A general description of the content of the tutorial

The tutorial will include presentations on modeling and representation of clinical guidelines and on the requirements for a sharable computer-interpretable representation of clinical guidelines. Guidelines encoded in the third version of the GuideLine Interchange Format (GLIF3) will be used to explain the meaning of the requirements and demonstrate the approaches to satisfying these requirements that were taken by GLIF.

An outline of topics to be covered

The material presented will be organized around the following topics:

- What are guidelines?
 - ◆ Types of guidelines
 - ◆ Types of guideline applications
- What are computer-interpretable guidelines?
 - ◆ Encoding decision logic
 - ◆ Structuring of guideline recommendations
- Benefits of computer-interpretable guidelines
 - ◆ Decision support
 - ◆ Verification and reliability studies
 - ◆ Quality assurance of the patient care process
 - ◆ Simulation for education purposes
- What kind of decision support can computer-interpretable guidelines provide?
 - ◆ Differences between decision support offered by computer-interpretable guidelines and text-based guidelines
- What is a sharable representation?

- ◆ Sharing a guideline in different clinical setting
- ◆ Integrating the guideline into different information system environments
- What are guideline-models and guideline representation formats?
 - ◆ Models and knowledge representation paradigms
 - ◆ Guideline models
 - ◆ Guideline representations
- What could be gained from a **standard** for a sharable computer-interpretable guideline representation?
 - ◆ Benefits from sharing guidelines
 - ◆ Issues in sharing computer-interpretable guideline representations
 - ❖ Local adaptation
 - ❖ Mapping to information system environments
- Functional requirements for a sharable computer-interpretable guideline representation
 - ◆ Expressiveness (authoring)
 - ❖ Being able to express different types of guidelines and clinical trial protocols
 - ❖ Being able to express different types of guideline knowledge components: recommendations, definitions, and algorithms
 - ❖ Being able to express different guideline tasks including decision making, sending alerts, goal setting, specifying work to be performed, and data interpretation
 - ◆ Human comprehension (authoring, use)
 - ❖ Support guideline visualization
 - ❖ Support readability
 - ❖ Complexity management
 - ❖ Supporting different views of the guideline (different users such as patient, MD, different settings, such a in-patient and out-patient)
 - ◆ Accessing patient data
 - ❖ Representing patient data (authoring)
 - ❖ Mapping guideline variables into the local electronic patient record (localization)
 - ❖ Support for using vocabularies and reference information models (authoring, encoding)
 - ❖ Support for expressing data abstractions (e.g., pharmacological agent) (authoring, encoding)
 - ❖ Handling semantic matches and range checks (encoding, use)
 - ◆ Structuring guideline output
 - ❖ Enabling multiple views of guideline output (localization, use)
 - ❖ Enabling better workflow integration (localization, use)
 - ◆ Handling negative recommendations and contraindications
 - ❖ Expressing negative recommendations (authoring, encoding)
 - ❖ Expressing what should be done if the negative recommendations are not followed (authoring, encoding)
 - ❖ Supporting an interactive mode that gives the negative recommendations only if it is necessary (the non-recommended option was considered by the user) (authoring, encoding)
 - ◆ Handling patient preferences
 - ❖ Representing patient preferences (authoring, encoding)
 - ◆ Representing costs and qualities of services (authoring, encoding, localization)
 - ◆ Expressive decision model
 - ❖ Automatic and non-automatic decisions (authoring, encoding)
 - ❖ Utility theory, patient preferences, cost-effectiveness, bayesian model, sensitivity analysis (authoring, encoding, localization)
 - ◆ Representing adverse conditions (authoring, encoding)
 - ◆ Handling uncertainties in data (missing and incomplete data)
 - ❖ 3-valued criterion semantics (True, False, Unknown) (authoring, encoding)
 - ❖ Providing recommendations despite uncertainty in data (authoring, encoding, use)
 - ◆ Linking the guideline to support material (authoring)
 - ◆ Present clear statements of evidence and recommendations:
 - ❖ Strength of evidence (authoring, use)
 - ❖ Strength of recommendations (authoring, use)

- ❖ Magnitude of anticipated benefits to following a recommendation (authoring, use)
- ◆ Expressing what cannot be changed in the guideline representation during local adaptation (authoring, localization)
- ◆ Representing goals (authoring, use, analysis)
- ◆ Documenting use-cases of guidelines: who uses and in what setting/situation (authoring, encoding, use, analysis)
- ◆ Ensuring reliability and safety
 - ❖ Ensuring reliability and safety within a guideline, among several guidelines that apply to a patient (simulation, testing)
 - ❖ Verification and/or validation capabilities (simulation, testing)
 - ❖ Documenting test cases that were run (authoring, simulation, testing)
- ◆ The representation format should be easily transportable among collaborators (text format, preferably, XML) (dissemination)
- ◆ It should be possible to share standard representations that are devoid of visualization and site-specific details (dissemination)
- ◆ Coupling guidelines to workflow
 - ❖ Resource allocation (authoring, encoding, use, analysis)
- ◆ Ability to link to vendor applications: interface to information systems data and functions (localization and implementation)
- ◆ Support different usage modes
 - ❖ Interactive vs. batch (usage)
 - ❖ Enable different possible user-interfaces (usage)
- ◆ Maintenance
 - ❖ Version control: dates, names of updating person, guideline-author, encoder, version number, ...
 - ❖ Change management: documentation changes in a structural way (authoring)
 - ❖ Ways to documenting the changes only, without specifying the full new version (authoring)
 - ❖ Documenting problems in a structured way (use, analysis)
- ◆ Support Analysis of user compliance with the guideline (available patient data, actions taken, decision options chosen, goals reached, adverse conditions and contraindications) (usage, analysis)
- ◆ Handle legal issues: disclaimers (authoring)

Educational goals

- Understanding what a computer-interpretable guideline is
- Understanding what kind of decision support can be provided by a computer-interpretable guideline
- Understanding why a standard for a sharable computer-interpretable guideline representation is needed
- Understanding the differences between a guideline model and a guideline representation format
- Understanding what makes a good guideline representation
- Understanding how GLIF3 meets some of the requirements posed for a sharable computer-interpretable guideline representation

Who should attend?

- Clinicians interested in using or learning more about computer-interpretable guidelines, their authoring and use
- Developers of clinical decision-support systems
- People interested in knowledge representation, knowledge-based systems and their modeling
- Stakeholders who want to understand how a standard for guideline representation could facilitate guideline sharing and how far we are from such a standard

Level of content: 40% basic; 40% intermediate; 20% complex

References from organizations that have previously sponsored tutorials of similar duration:

Aziz Boxwala has presented this and related topics at several international scientific meetings and in educational settings. Recent presentations have been:

1. An invited seminar at the Yale Center for Medical Informatics, 1999 (Dr. Perry L. Miller perry.miller@yale.edu).
2. Panel participant in AMIA Fall Symp. 1999 (Panel chair: Dr. Mark Musen, musen@smi.stanford.edu)
3. Demonstration at Integrating the Healthcare Enterprise, Chicago, IL (Program Chair: Dr. Robert A. Greenes, greenes@harvard.edu)

References:

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Mor Peleg has given presentations in international and local conferences and workshops (Prof. Dov Dori, dori@ie.technion.ac.il; Prof. Shortliffe, ehs@stanford.edu) She was an instructor in a commercial genetic engineering workshop entitled “Touching the Genes” that was held in the Technion – Israel Institute of Technology (zlev@tx.technion.ac.il). She was twice awarded the “excellent instructor” prize by the Technion – Israel Institute of Technology (dori@ie.technion.ac.il, zlev@tx.technion.ac.il) and has lectured and instructed in tutorial sessions and laboratory sessions in the years 1991-1999 in the Technion – Israel Institute of Technology (dori@ie.technion.ac.il).

References:

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Prerequisites: none

Audio-visual equipment: Projector capable of projecting PowerPoint slides from a laptop.