Using clinical guidelines in an eLearning context

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Abstract: Clinical guidelines have been widely used to standardise medical practices according to scientific evidence, aiming at improving quality and reducing risks. In this paper we discuss how clinical guidelines are also extremely useful in an eLearning context. The information contained in the guideline, its decision workflow and its execution with real patients can be the basis for both formal and informal learning processes involving medical students, medical professionals or patients. We present different learning scenarios based on the use of clinical guidelines. We also describe the main elements of our guideline execution engine which is currently under development.

Keywords: clinical guidelines, eLearning, formal learning, informal learning, lifelong learning

1   Introduction

Clinical guidelines are defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (Institute of Medicine, 1990). A clinical guideline is a document describing a set of explicit recommendations, based on scientific evidence, with the aim of guiding medical professionals and patients. Other commonly-used names for "clinical guidelines" are "medical guidelines", "clinical practice guidelines" and "clinical protocols".

A clinical guideline addresses a specific medical problem and may be related to one or more stages of the problem, as for instance prevention, diagnosis or therapy. A clinical guideline summarises consensus information related to the medical problem, and then it addresses practical issues. It defines the main questions related to clinical practice and

identifies a workflow of all possible decision options and their outcomes. This way, the clinical guideline provides a protocol of decisions and actions to be taken. Depending on the focus of the guideline, these actions may consist of, for instance, specific clinical tests to be carried out (in diagnosis guidelines) or specific medications (in therapy guidelines).

As we can observe, the main objective of clinical guidelines is to standardize medical care, improving quality and reducing risks, based on scientific evidence. Some guidelines also may focus on other aspects as the improvement of the efficiency and the reduction of costs. We will see in Section 3 that guidelines also offer a valuable tool in the education of medical professional and patients.

Clinical guidelines are usually developed at national and international levels by medical associations and governmental institutions. These top-level guidelines are usually adapted by local organizations, such as hospitals, to produce their own guidelines.

Although the use of clinical guidelines presents clear advantages, the development of a big number of guidelines in the last years has originated situations where different guidelines contain conflicting recommendations. Quality in the process of development of guidelines has become an increasing concern (Grilli et al. 2000 and Shaneyfelt et al. 1999). There is a clear need for a common, valid and transparent approach to develop good clinical practice guidelines. In Europe, the AGREE (Appraisal of Guidelines, Research and Evaluation for Europe) instrument (AGREE Collaboration 2001) has been developed to provide a tool for the assessment of the quality of guidelines. This tool can also support guideline developers to follow a rigorous development methodology.

Clinical guidelines are often published in on-line catalogues, which are mainly build at national level usually maintained by Health ministries. The biggest one is the National Guideline Clearinghouse[1] (NGC) from the USA, that comprises more than 2,000 guidelines, that have to be published under the auspices of a medical association or a government agency and developed or revised within the last 5 years. Other on-line databases are of significant importance in the development of clinical guidelines. The most salient are the Cochrane[2] evidence-base medicine database, as well as other medical literature databases, as the PubMed[3].

A guidelines execution engine is a software component that runs a clinical guideline for every different patient. The guideline is represented in a structured way, as so the patient's data is. The guideline execution engine enables the medical professional to follow the workflow for each patient, as well as to receive the recommendations from the guideline at each step. Guideline execution engines are also usually referred as medical decision support system or as interactive clinical guideline.

It has to be noted that, although a big number of guidelines are published in catalogues like NGC, they are represented in an unstructured way, usually through PDF files. Guidelines have to be modelled in order to be run in an execution engine. However, different engines use different models, making interoperability impossible. To solve this problem, some specifications have been developed to model clinical guidelines in a shareable way. Unfortunately, none of them has become a standard. GLIF (Guideline Interchange Format) (InterMed Collaboratory 2004) is probably both the most complete and the most widespread among them.

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[1] http://www.guideline.gov
[2] http://www.cochrane.org
[3] http://www.pubmed.gov

The rest of the paper is structures as follows. Section 2 describes the structure of an application for running clinical guidelines, in particular the Guideline for the prevention of colorectal cancer (Asociación Española de Gastroenterología et al. 2004). Section 3 discusses different scenarios where clinical guidelines can be used in an educational framework. Finally, Section 4 states the main conclusions as well as the following steps in our work.

2   An application to run clinical practice guidelines

We describe in this section the main elements of our guideline execution engine. This engine is being developed with the main objective of running the Guideline for the prevention of colorectal cancer (Asociación Española de Gastroenterología et al. 2004). It has to deal with patients data and control the decision workflow specified in the guideline, providing the corresponding recommendations to the doctor.

Nevertheless, the final objective is to build a more general engine, capable of running other guidelines. We have chosen a subset of GLIF to model guidelines in a shareable way. Note that GLIF is a quite complex specification and contains many classes apart from those specifying the decision workflow. Our subset contains all the entities that are defined in GLIF to model the different types of steps in the workflow (Decision_Step, Action_Step, Branch_Step, Synchronization_Step and Patient_State_Step). GLIF contains references to didactic materials that can be related to the overall guideline or to specific sections. Our subset also implements these elements for didactic materials.

Unfortunately there are no libraries for managing GLIF models, so we are currently developing a Java library to manage them, that will be the core of the engine. Figure 1 shows a general architecture for the engine.

The engine has also to keep track of the decisions for specific patients. Note that while guidelines are modelled in GLIF, this specification does not cover patients executions, and consequently a schema to represent them has also been defined.
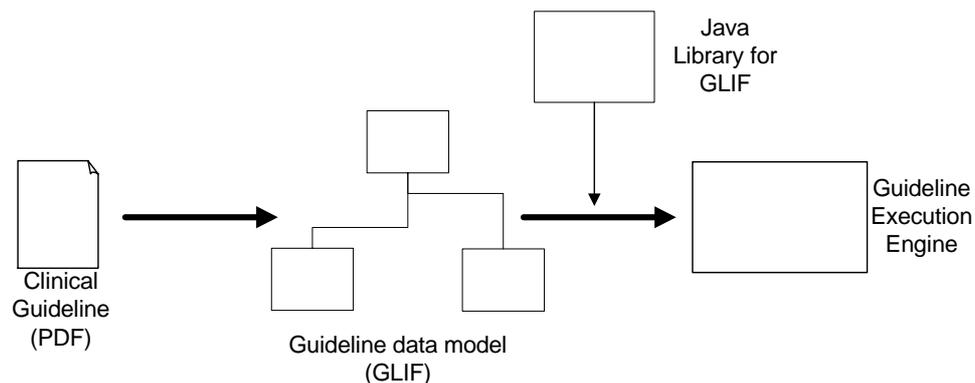

Figure 1. General architecture for a guideline execution engine using GLIF

3   Clinical guidelines in an eLearning context

Clinical guidelines contain a systematic review of the scientific evidence focusing on a specific medical problem. Furthermore, they provide an integrated view on how to address the problem in practical terms: which decisions should be taken in each situation. All this information can be used as a valuable source in the learning process of Medicine students, as well as in the continuing education of medical professional. Studies show that practice-based education through guidelines and decision support systems improve the detection of diseases. (Feder 1995) shows the improvement of the results of detection of asthmatic and diabetic problems in primary care, while (Downs 2006) shows the results of detection of dementia in primary care, compared to other educational options.

Medical students and professionals can also learn from executions of guidelines with data of real patients. Simulation tools where students or professionals have to determine the right decision in situations taken from real cases can also be useful for learning.

Clinical guidelines can also provide a helpful information for patients that want to be informed on their situation. Especially relevant for patients are prevention guidelines, since patients are usually required to play an active role in this case.

We will now present four different learning scenarios where the clinical guideline for the prevention of colorectal cancer can be used.

Scenario 1

A medicine degree student has registered for the subject called "Gastroenterology". A module of this subject is given by means of e-Learning and is based on clinical guidelines. The student analyses the scientific evidence related to each guideline. Then he has to study the corresponding decision workflows. He will put these concepts into practice through solving specific cases as required by the course's proceedings. The student also communicates with other peers in order to share advice and solicit support in addressing the challenges generated by the clinical guideline.

This scenario provides an example of using guidelines and their executions in the context of formal learning. Communication is an important issue here too.

Scenario 3

A person is suffering from syndromes that might be related to colorectal cancer. The diagnosis procedures and their course is difficult for him to follow and understand. However, the patient will be much more comfortable through the diagnosis period if he understood the procedures exactly. The patient raises the issue with his doctor who recommends him the use of an interactive clinical guideline as part of a learning program dedicated to the patients under colorectal cancer diagnosis. The system synchronizes the patient's digital copy of the clinical guideline with the information recorded on his doctor's computer, and simplifies medical matters in order to make the process understandable by non-medical persons.

This scenario provides an example of customization of the information and its visualisation. This is a key element in order to enable patients to understand guidelines.

Scenario 3

A family doctor is trying to diagnose a patient with unfamiliar set of symptoms in order to prevent the development of colorectal cancer. In his work in an isolated city of a remote area, he has difficulties maintaining contact with experts in gastroenterology in order to share knowledge and experience. He decides to use an online eLearning and knowledge sharing system through which he can maintain relationships with other doctors and solicit support whenever needed. The system uses clinical guidelines, as well as a repository of real patient's executions (of course, keeping anonymity). Colleagues can respond to questions from peers quickly and efficiently without having to spend a lot of time of studying the relevant case.

This scenario provides an example of using guidelines as the base of a learning community.

Scenario 4

A doctor is specialist in cardiology and gastroenterology, but during most of years in his practice, he has only concentrated on cardiology specialities as part of his work in the local hospital. Recently, a post in the hospital has opened for an gastroenterology specialist, so he decided to give it a try. On the other hand, he knows that he needs to refresh his knowledge about gastroenterology area. He then uses an interactive clinical guideline designed to simulate the diagnosis and prevention measures associated with real cases in order to sharpen his skills in this area. By trial and error, he is able to recuperate and update his skills in the area of gastroenterology in a matter of weeks without taking classes or training courses.

This scenario provides an example of a process of refreshing memory in a context of informal learning.

4 Conclusions and further work

The scenarios described in the previous section show how clinical guidelines can be used in the context of formal and informal learning. In the case of medical professionals, it is a good example of lifelong learning based on competences acquisition.

Our plans for future work include the use of guidelines and their executions in the TENCompetence client, as the basis for a business pilot. A repository containing clinical guidelines, as well as executions of real patients, will be defined. Finally, a middleware will be built to enable the communication between the TENCompetence client on the one hand and the repository and engine on the other, as Figure 2 shows.
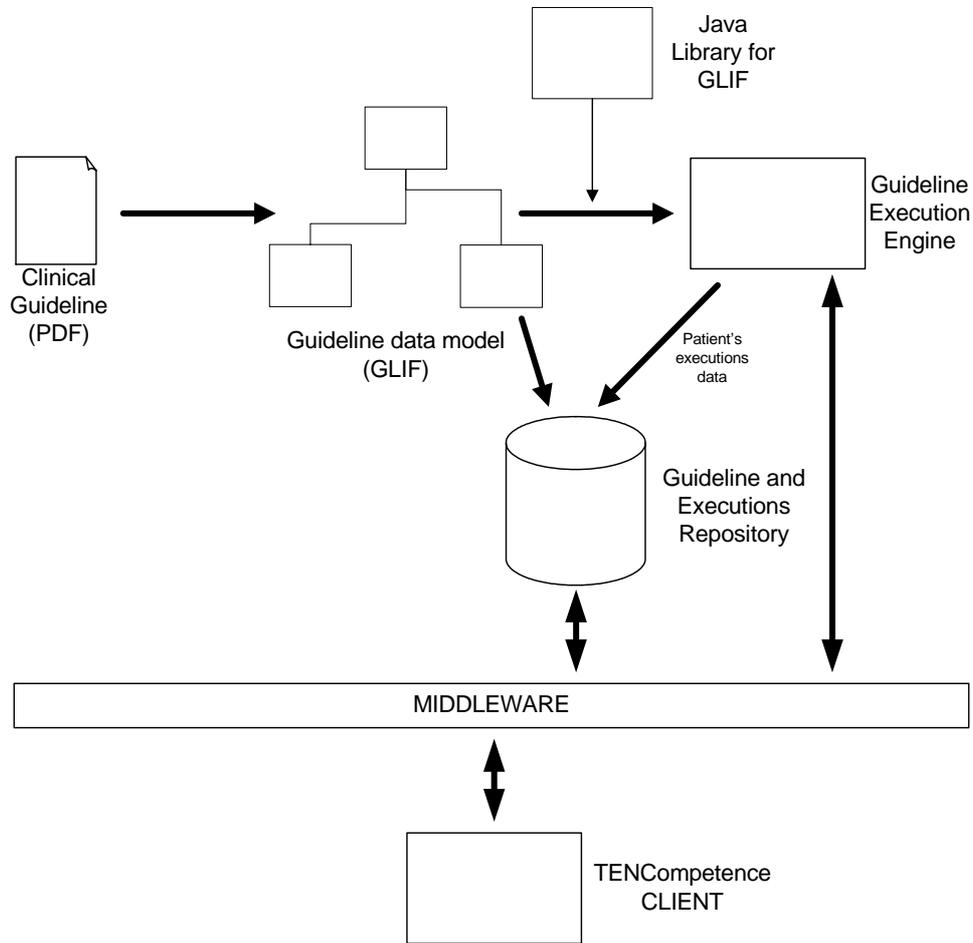
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Figure 2. Proposed architecture for using clinical guidelines with the TENCompetence Client

Acknowledgment

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