THE CLINICAL GUIDELINES USAGE TOWARDS THE DIAGNOSIS AND TREATMENT OF H1N1

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Abstract—**In medical clinics, guidelines are the best ways for practitioners to make good decisions on patient's medical problems. There are different kinds of symptoms at all kinds of illnesses and this will affect the medicians' decision on the diagnosis/treatment. These guidelines are the results of an algorithm to follow and the ways to defeat the illness. These guidelines are developed in textual format. In order to process them in computer systems, a machine procesable format, called GLIF, is developed and this format is widely used througout the world. In this way, the clinical guidelines can be encoded in GLIF format and they can be used in hospital information systems. Currently, H1N1 pandemic flu (i.e. Swine flu) is a global threat. Only in Turkey, there are about 350 casualties as annouced by the Ministry of Health. Furthermore, Ministry of Health published a guideline towards the diagnosis and initial treatment of H1N1. However, it is in textual format; in other words it is not machine processable. In this paper, we have developed a system, called H1N1Diagnose, to be used in the diagnosis of the H1N1 flu. In this respect, we first developed the GLIF format of the textual guideline and then implemented a guideline execution engine that process the guideline. In other words, this is an expert system that helps the practitioners for the analysis of patient data and make the diognosis. Indeed, the system is not specific to a single H1N1 guideline. It is generic in that it can process any guideline in GLIF format.**

Keywords-component; Clinical Guidelines, GLIF, Expert Systems, H1N1 Pandemic Flu

I. Introduction

The guidelines usually include the plans for treatment. Their scope is ultimately assist the physician in clinical decision by providing evidence based approach to certain conditions. Their aim is to provide a unique standart optimal healthcare based on the general evidences and applications of desease. The advanteges of guidelines are[6]:

Improved patient safety by reducing medical errors and improving selection of rightmedication and laboratory test

Improved quality of care by facilating the use of up-to-date clinical evidence

Improved efficiency in healthcare delivery by reducing test duplications and incidences of adverse event.

How the guidelines are developed[1]? This question has various answers. They are usually developed by Task Forces of experts in the field such as "The Task Force on the Management of Acute Myocardial Infarction of the European Society of Cardiology" or by National and International Medical Societies such as "Infectious Diseases Society of America". These guidelines are being updated every 4-5 years and usually represent standart of knowledge that is recommended to be followed by the medical practitioners in their clinical practice. Guidelines are usually provided as narrative descriptions accompanied by flowcharts, as presented down at Figure 2 [2]. In this work, we have used the clinical guidelines in the diagnosis and treatment of H1N1 flu. We first developed the Guideline Interchange Format (GLIF) [12] guideline model for the clinical guideline published by the Ministry of Health Turkey. After that we developed the H1N1Diagnose system for the execution of the guideline. Basically, in this system, the practitioner inputs the patient data obtained during the patient encounter and obtains the recommendations generated by the system. It should be noted that the system is not specific to a single guideline and it can be used with any guideline as long as it is encoded in GLIF. The paper is organized as follows. We first explain the advantages of computer-based guidelines on paper-based guidelines. After that we provide some details of GLIF. Then we describe the H1N1Diagnose system. Finally, we conclude the paper.

II. PAPER-BASED VERSUS COMPUTER-BASED GUIDELINES

Although there are relatively few health care sites where practitioners routinely use computer-based implementations of guidelines, there is good evidence that such computer-based systems can have a positive effect on patient care. During the last decade, several computer-based models have been developed to represent Clinical guidelines in computer-interpretable formats. An important goal in developing these models is to make the encoded guidelines sharable across different institutions, there by saving the huge resource investment in the process of guideline development and implementation. Still there are some problems that are need to be sold.

First of all the biggest problem is interoperability of the guidelines. For a patients illness, maybe one guideline will not be enough because, one symptom can direct doctor to different illness and change the flow that means guidelines must direct to each other . The patient history must be stored at a library and all guidelines must use this library to analize the results. Using that libray becomes a problem for guidelines to use the same syntax for Electronic Medical Records of hospitals. Also to find the patient history from beginning of his life up to now and use at the guideline all the clinics must be part of the same database. As we see the globalization problem is the biggest problem for computerized clinical guidelines, but even if they are not global, they can direct practitioners to good solutions, They can prevent the waste of time and they can help doctors with the knowledge gained before, through study of other patients who suffered same illnesses. These problems are cited as the main obstacles for achieving fully sharable and deployable clinical practice guideline implemantations.

The available clinical guideline execution engines often address the automation in a single homogenous healthcare institute and eighter built on top of an already available clinical information system, as an integrated add-on feature, or require custom adaptation phases to communicate with clinical applications such as for accessing the patient records or invoking medical services. These adaptation phases usually consist of manual mappings of the data models used in clinical guidelines to the data models used in clinical repositories, and manual binding of clinical events supported by the underlying clinical information system to the action definitions in clinical guideline execution environment.

In 1998, the InterMed Collaboratory, developed the GLIF [12] as a guideline representation model aimed at sharing clinical guidelines among different institutions. Later, a prototype execution engine was designed and implemented to integrate with a generic clinical information system for the execution of guidelines encoded in an enhanced format of the second version of GLIF (GLIF2). Subsequently, the limitations of GLIF2 have been overcome and new requirements for guideline modeling have been included, resulting in the third version of GLIF which is GLIF3.

The other computer interoprable models of guidelines are ASBRU[13], PORforma [14], ARDE [15]and EON[16]. For these all guidelines different semantical methods have been followed .First of them is rule-based formalisms and these guidelines are represented as cause-effect relationships. Second method is network based models where algorithms or hierarchical task networks are used.

III. GLIF SYSTEM ARCHITECTURE

The GLIF[5] specification consists of the GLIF model and the GLIF syntax. The GLIF model consists of a set of classes for guideline entities, attributes of those classes, and data types for the attribute values. A particular guideline encoded in GLIF is an instance of the general guideline model. GLIF model is proposed as a standart interoperable representation model for sharing clinical guidelines among different healthcare institues. In this model clinical guidelines are represented as instances of a formal model called Guideline. This formal model is represented as an ontology editable by Protege. To encode a guideline according to the GLIF model, authors express the guideline knowledge using GLIF syntax. The GLIF syntax specifies the format of the text file that contains the encoding.

We talked about the three version of the GLIF. At the last version, the guidelines are described in three layers: first, at the conceptual level as a flowchart, second, by defining the medical concepts involved in the guideline definition as an ontology. The third one is the clinical information system.

In GLIF[11], guidelines are represented as a flowchart of temporally sequenced nodes, called guideline steps. Different classes of guideline steps are used for modeling different constructs:

- Decision_Step
- Action_Step
- Branch_Step and Synchronization_Step
- Patient_State_Steps

Decision Step class represents decision points in the guideline. A hierarchy of decision classes provides the ability to represent different decision models. Action Step used for modeling actions to be performed. Action steps contain tasks. Two distinct types of tasks can be modelled: medically oriented actions such as a recommendation for a particular course of treatment, and programming-oriented actions such as retrieving data from an electronic patient record. Specify clinical actions that are to be performed in the patient-care process. An action step may name a subguideline, which provides greater detail for the action. Each action step contains exactly one action specification and one pointer to the next step in the guideline. An action specification has a name, a list of patient data, a description of the action in narrative text, and an optional list of associated supporting didactic materials. If the action involves the collection of patient data, such data are specified as a set of data elements associated with that particular action. The Branch Step schedule multiple subsequent steps. direct flow from one guideline step to another. A conditional step may link any guideline step to any other guideline step. A conditional step contains a condition, or criterion, which is a logical statement that may be evaluated as true or false. If the condition is true, then control flow goes to the step specified by the destination attribute. Alternatively, if the criterion is false, control flow goes to the step specified by the otherwise attribute. No transition is specified if available data do not allow evaluation of the criterion. Synchronization Step are used in conjunction with branch steps and evaluate continuation criterion, schedule next step. When a branch step is followed by multiple guideline steps, the flow of control must eventually converge in a single step. Each branch may lead to a series of steps, resulting in a set of branching paths. The step at which the paths converge is the synchronization step. The direct predecessors of a synchronization step can be any type of guideline step; at some previous point, however, there must have been a branch step. When the flow of control reaches the synchronization step, a Continuation attribute specifies whether all the preceding steps must have been completed before control can move to the next step or whether just one of the branches needs to have been completed before control can move on. Patient_State_Steps serve as entry points into the guideline as well as allow for labeling patient states.

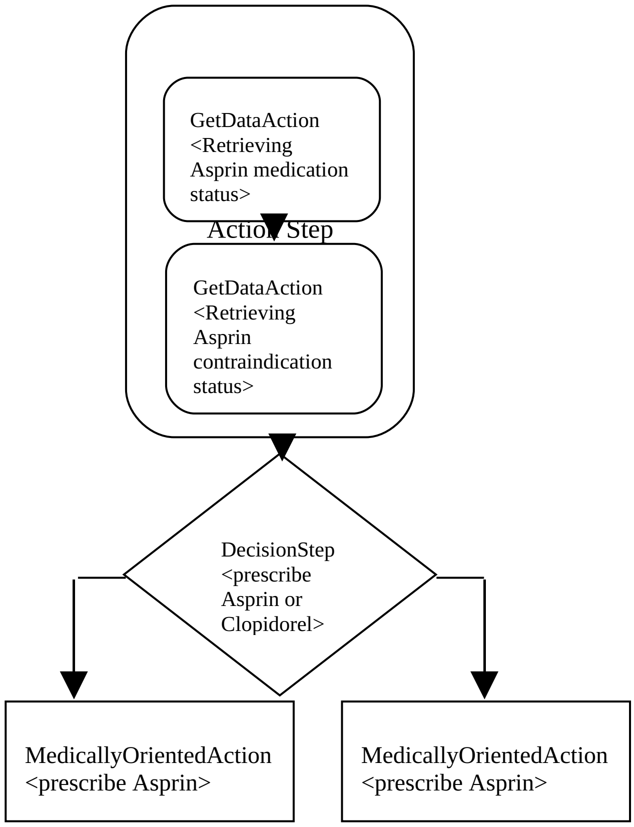

Figure 1:Here is a small instance of a guideline execution.

Encoded guidelines that were produced by the subjects, the use of GLIF3[9] appears to offer several improvements over GLIF2 in the ability to encode guidelines accurately and efficiently. First, the contruction of the guidelines and their model is changed at GLIF3. Second, the guidelines encoded in GLIF3 contain more details then guidelines encoded in GLIF2. The third difference is some ambiguities in the GLIF2 are not some at GLIF3. These changes are needed because there is a lack of formality at GLIF2 and that leads to some ambiguities at the guidelines. The increased formality of the GLIF3 model and syntax leads to a guideline-encoding process that contains both a greater level of detail and less ambiguity than that in previous versions. The result of such improvements is an encoded guideline which is better equipped to aid practitioners as they make decisions in a variety of clinical settings.

The GLIF3 is an object-oriented model that consists of classes, their attributes, and the relationships among the classes, which are necessary to model clinical guidelines. The model is described using Unified Modeling Language (UML) class diagrams [10]. Additional constraints on represented concepts are being specified in the Object Constraint Language (OCL), a part of the UML Standard.

IV. H1N1Diagnose

The H1N1Diagnose, is a tool to support the execution of clinical practice guidelines encoded in the GLIF format. In addition to clinical decision support, H1N1Diagnose aims to be used for better decisions, guideline development, and medical education. H1N1Diagnose is developped by using JAVA programming language. H1N1Diagnose supports user-controlled task scheduling to provide extra flexibility in guideline execution.

In this system, we first developed the GLIF guideline model for the clinical guideline published by the Ministry of Health Turkey. After that we developed the H1N1Diagnose system for the execution of the guideline. Basically, in this system, the practitioner inputs the patient data obtained during the patient encounter and obtains the recommendations generated by the system. It should be noted that the system is not specific to a single guideline and it can be used with any guideline as long as it is encoded in GLIF format.

Four execution states are used to represent the status of a guideline step during the guideline execution process. Prepared state means a step that will be executed next by the execution engine started state means a step has been started by client stopped state means a step that has been stopped by client before it starts or completes its execution, and finished state means a step that has completed its execution. We call prepared state and started states as active state and finished state, stopped state inactive state.

V. DISCUSSIONS AND CONCLUSIONS

The world is facing the challange of delivering high quality healthcare at affordable cost while the population is growing. Chronical diseases and their management costs are also increase as the population grows. In parallel of these things the doctors job is more complicated now and solutions must be quick and usefull for them. Intelligent expert systems are the best supporters of practitioners and finds efficient solutions to complex problems.

These systems are in need of formally expressed domain knowledge and in healthcare domain, the domain knowledge in clinical practice is usually represented as clinical guidelines which provide evidence based diagnostic and therapeutic guidelines given a certain clinical condition.

Although clinical decision support systems based on clinical guidelines are seem to be promising supportive tools for medical practitioners, there are some critical challanges that should be adressed to achieve wide adaptation of such tools. First the guideline execution environments need to acess the medical histories of the patients to find a personal solution instead of a general solution for each patient. Second the clinical support systems need to seamlessly interact with the underlying clinical workflow applications so that the suggestions of the clinical guidelines can be reflected as clinical workflow actions.

GLIF is designed to handle a greater variety of guideline types and still improving. Different problems must be sold at GLIF4 in the future. First ,same clinical vocabulary or coding system for concept representation must be used at different institutions to achive a unique generic guideline solutions.In the absence of same vocabulary , shared data and distributed guidelines are impossible. Second there are some differences between the decision making process of computerized systems and the doctors which we call as initiative. Third the patient data cannot be obtainable because of absence of old records of patience. This can prevent doctors to thrust the guideline results thorougly.

Although there are problems to be sold about computerized clinical guidelines, as the technology improved, there will be beter capabilities to store patient data, more distributed systems will hep us to use uniq standart language for this storage and better middleware will support platform independency [17].

In this paper, we develop a system, called H1N1Diagnose, to help practitioners in the treatment of H1N1 pandemic flu. For this purpose, we first encoded the GLIF format of the textual guideline and then implemented a guideline execution engine that process the guideline. In other words, this is an expert system that helps the practitioners for the analysis of patient data and make the diognosis. Indeed, the system is not specific to a single H1N1 guideline. It is generic in that it can process any guideline in GLIF format.

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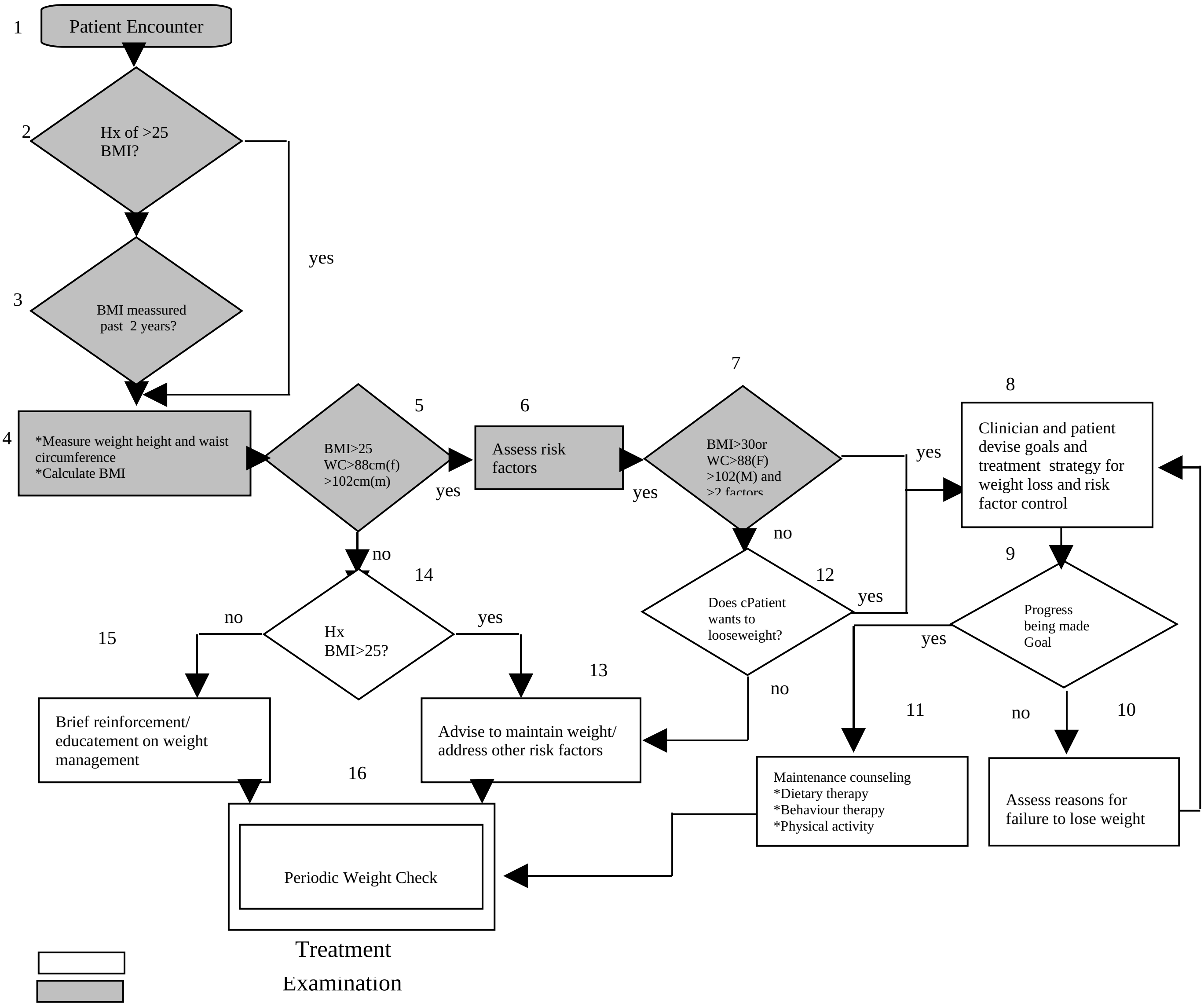

Figure 2:At this flowchart we can see the algorithm for "Obesity and Overweight".