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E-learning for Occupational Medicine Through an Interactive Guidelines Tool

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Abstract and objective

We are developing an E-learning system for allowing the occupational medicine physicians to be updated on the most recent guidelines (GLs) in his/her area. The system will be particularly focused on GLs developed within a joint initiative between the "Fondazione Maugeri Clinica del Lavoro e della Riabilitazione IRCCS", involved into occupational medicine since its birth, and the Italian Society of Occupational Medicine and Industrial Hygiene. These guidelines are currently available in textual format (booklets) and, within the project, they will be computerized and used in interactive modality for educational purposes.

Keywords:

e-learning; guidelines; occupational medicine

Introduction

As a consequence of the continuous technological and organizational changes of industrial production activities, occupational medicine increasingly needs a systematic and timely enlarging/updating of its scientific basis and intervention methods. In the near future, occupational medicine physicians will be given supplementary tasks, with respect to the traditional, clinical ones: in addition to medical encounters and healthcare surveillance, they will have the role of consultant for risk evaluation and management, information and education of workers, and the management of burocratic and legal issues.

Within the project "e-learning for the quality of life and the safety in occupational environment", funded by the Ministry of Health, an activity for the continuous education via e-learning has been designed. As first step, an analysis on the educational needs of 300 occupational medicine professionals has been performed through an ad hoc built questionnaire, in order to identify the topics of the learning activities according to the real needs of the potential users. The results, not yet published, pointed out interest as to communication skills, models and strategies for the prevention and control of risks, prevention and surveillance for specific expositions.

Guidelines (GLs) are one of the matters to be administered through the E-learning platform (A-Tutor). In the following sections we explain how GLs may be taught in an interactive way, that we consider more attractive, efficient and effective.

The GL interactive tutorial will be tested on:

- a set of guidelines already available as textbooks, among which: prevention of occupational dermatitis; health surveillance of workers exposed to inorganic lead and other inorganic substances; health surveillance of workers exposed to pesticides; health surveillance of workers exposed to styrene
- a set of rules to implement the risk evaluation and control plan [1]

Methods

The goal of the work is to create a GL repository, that can be browsed and interactively used with real or simulated cases through a portal, that will be the final user interface. Thus, the first step is to represent GLs with a homogeneous computational formalism. GUIDE, a tool developed within our department, will be used to this aim [2].

GUIDE components are organized in a distributed architecture: an editor to formalize guidelines, a repository to store them, an inference engine to implement guidelines instances in a multi-user web environment, and a reporting system storing the guidelines logs in order to be able to completely trace any individual physician guideline-based decision process.

While most traditional systems are limited to display GLs as hypertexts through a web portal, in the proposed architecture, GL-embedded knowledge is represented also as an hyper-flowchart, which allows to:

- represent GL in a synthetic way, as a sequence of tasks and decisional points;
- represent different detail levels without loosing the general view of the GL;
- link to specific sessions of the original GL text, to obtain explanations on a given task;

- suggest the GL-compliant behaviour both in real and simulated cases;
- query the user on cases generated by the system itself (simulated cases) and critically evaluate user's answers

Moreover, if different versions of the GL exist for different users (physician/ nurse/ worker/ etc.), the user will find on the portal the appropriate version according to his role.

Whenever, during a GL running, a user's answer is not GL-compliant, the user is asked for a motivation: may be that answer is due to lack of knowledge, but also it might be due to a reasonable different opinion.

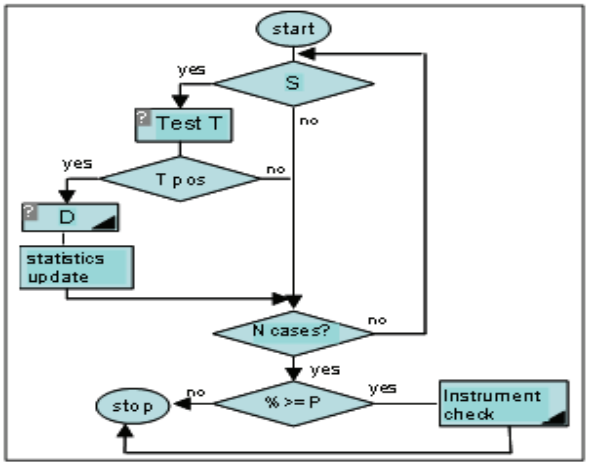

Figure 1 - Formalization of a generic guideline as an hyper-flow chart

Results

To clarify the expected results by a simple example, let suppose to have this GL:

" If the worker is exposed to the potentially dangerous substance S, then he must undergo test T regularly (each 6 months). The test has sensibility equal to k% and specificity equal to h%. If the test result is positive, the individual must be treated with drug D (recommendation supported by scientific evidence reported in L). Administration modality of the drug is the following: begin therapy with a dose d for three days,then shift to dosage d2 for two weeks, then decrease gradually and stop in three months. After having tested N workers, in case the percentage of positive results is above a predefined threshold P%, instrumentation S, present in the farm must be carefully controlled (quality check).The protocol for the quality check is the following: ..."

Its formalization is shown in Figure 1, representing the most general GL level:

Tasks "D" and "Instrument check" show a triangle in their bottom right, meaning these tasks are expandable into more detailed flow diagrams. For example, D task will be expanded in a diagram explaining the drug administration protocol.

Tasks "Test T"and "D" show a question mark in their top left, meaning that it is possible to access an explanation about that recommendation. About test T, the user can see studies on its sensibility, specificity, positive and negative predictive value and accuracy in different testing conditions. From task D, scientific publications about the drug effectiveness, cost and side effects can be found.

System-user interaction

The steps for using the portal are the following:**1.**The user, that must be previously registered, logs-on, allowing the system to retrieve his/her profile (including role)

2. he can browse the GL repository, searching GLs by keywords: for example he can retrieve all the GLs related to the effect of noise in the working environment
3. after choosing the GL, he can simply "study" it, using the hypertext modality
4. then, he can focus the major issues by means of the hyper-flowchart modality, that is more synthetic, modular, and easily allow both general and particular views
5. Then the user may check his performance by two modalities:
    a. "learning by examples": the user provides data for a particular case study and the system show the *solution*, that is the path(s) of the flowchart that represents the GL recommendations for that case
    b. "learning by critiquing": the system generates data of a hypothetical case (simulated case) , the user proposes, step by step, a sequence of actions, and the system advises him if the user-proposed process is not compliant with the GL

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