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eBlood: A Web 2.0 Simulation System for Blood Safety

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Abstract: **Nowadays, improving quality and sustainability is a main concern on health care and simultaneous inputs, from business, technology, design and health fields are essential for progress. This paper describes a web 2.0-based simulation system for blood transfusion – the eBlood system -, that enables to**

propose and to discuss the reengineering of the whole transfusion chain. The simulation process is based in an interactive video model of the actual process, where each step has been associated to costs and errors in real context. The system allows the contribution of experts who can agree or disagree with the information about errors or costs, and add their own tacit knowledge. eBlood has been implemented in two hospitals in the region of Barcelona with the aim to help them to adopt new technologies to enhance transfusion safety, and facilitate the commercial relation with service providers.

Introduction

Reducing medical errors and improving patient safety is an area where information technology has a major impact [1]. In the blood safety arena, there is a need to develop systems for enhancing the quality of transfusion process and increase the security of patients [2] [3]. Besides, even when incident reporting systems are required within transfusion medicine, there is a lack of strategies and tools to help study what occurred, and what actually caused the mistakes [4].

Another difficulty in this arena is the problem to develop empirical essays of new technologies. It's not the technological aspect which represents the

biggest difficulty but the organizational one. This paper presents a web 2.0- based simulation system – the eBlood system - that enables to make virtual reengineering essays of new process in the blood transfusion chain

eBlood

Specifying the eBlood Design Process

Four phases have been defined to develop the eBlood system prototype.

In the first phase, several aspects have been studied: the current blood transfusion process in two spanish hospitals, the available technology for future process, and scientific literature about similar experiences. This first step can be achieved only when all the technical components of eBlood are available. The key tasks in this phase include designing and developing: the mathematical model; the simulator' databases; the interactive video production process; the system interface design, programming applications, and alpha and beta tests.

In the second phase, the aim is to describe the current blood transfusion process clearly. It includes: defining all the steps in the process (each step is defined as a scene); identifying the scene at which errors occur; the allocation of costs to each of

the scenes, and the assessment errors' costs in the various units. The research work is based in hospitals visits, interviews and meetings with selected experts. The final outcome is a detailed description of the blood transfusion represented in a multimedia video format. This version of the system includes also a first approach of data with their identification of costs and errors in the different parts of the process. Data is provided by experts.

Once the simulator is built and prepared with real data, users can interact with eBlood. Users have different profiles. Some of them can watch the whole scenes which compose the multimedia video. This is the case of visitors to the web. However, blood experts can participate in a consensus dynamic for sharing information and modify data in the scenes. They can discuss to achieve a consensus of the whole blood transfusion chain. So, eBlood acts also as a platform to gather explicit and tacit knowledge from all the participants. This represents the third phase, and a test is developed with local experts in Spain. The validation of the current model and the consensus tool are the outcomes of this stage.

Finally, once the system prototype has been improved through the past three phases, discussion is promoted with the aim to achieve a consensus about one or more options of new processes supported in technology. In this case, the application of eBlood to the assessment of a process renewal proposal will probe its potential in the moment an empirical essay be consider. Then, the result will consist in a new consensual theoretical model

which can be tested in real context and with more guarantees of success, because it has been defined with a better awareness of current process and because all the human agents involved in the blood transfusion chain have participated.

The eBlood System

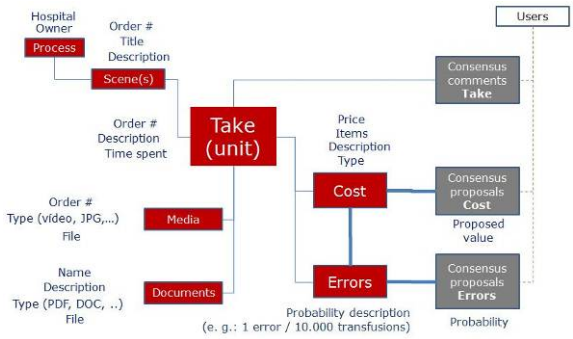
Taking as a reference the film production language, a first operational prototype for eBlood has been developed. Fig. 1 represents its general structure model. A "Take" is the simulator central entity.

Acknowledgment

Fig.1 eBlood Data Structure Model

The blood transfusion process is presented by chains of different steps, which we call takes, and which are grouped in scenes. A scene can be composed of several takes. Both scenes and takes are ordered according to execution in real life. Takes are registered in video or other digital means. See Fig. 2.

Fig. 2 eBlood Data Structure Model The eBlood system covers the following requirements:



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a) Visualization. Support learning through visualizing only the original blood transfusion process (Available for users with a visitor profile).

b) Consensus and Discussion about processes. It supports adding comments to the content in the system. Users can comment each take, suggests new values for costs and discuss about error probabilities.

c) Process Edition. Users with a tutor profile can modify values in relation to costs and errors. They can also manage take and scenes.

Future Work

The proposed work is still in progress. It has taken a year for discussing about the opportunity of a simulator like this. We have already designed the first prototype model with the collaboration of an interdisciplinary team. More than 5000 thousands hours have been necessary to justify the opportunity of the project, design the prototype, achieve consensus about the model, to reproduce in video the real process, and so on.

Nowadays, we are validating the proposed model with a first trial of the system where experts, physicians and nurses discuss about the actual process. Results of this experience will provide improvements to the system before a second trial with a more wide health community.

Finally, we will invite technology providers in the health sector to utilize this model to define and validate new processes by theoretically simulating the use of new technology.

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