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Developing an eLearning Tool Formalizing in YAWL the Guidelines Used in a Transfusion Medicine Service

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Abstract. The blood transfusion is a complex activity subject to a high risk of eventually fatal errors. The development and application of computer-based systems could help reducing the error rate, playing a fundamental role in the improvement of the quality of care. This poster presents an under development eLearning tool formalizing the guidelines of the transfusion process. This system, implemented in YAWL (Yet Another Workflow Language), will be used to train the personnel in order to improve the efficiency of care and to reduce errors.

Keywords. Transfusion, YAWL, workflow, guidelines, eLearning.

Introduction

The transfusion medicine can be considered the critical core of laboratory medicine. The blood components (BC) transfusion represents a life-saving treatment in selected cases. In order to guarantee safety, efficiency and effectiveness, the transfusion cycle must be fully traceable. With this aim, the Melegnano Hospital manages the transfusion process by the EmoNet software which, however, doesn't provide a complete guideline-oriented workflow. YAWL (Yet Another Workflow Language) is a complete and new language with independent semantics inspired by Petri nets, able to support every workflow pattern [1]. A graphical editor and an execution engine are provided as Open Source software. We selected the YAWL software to develop an eLearning tool which would simulate our complex SOPs workflow and integrate all our technologies.

1. Methods

1.1. Standard Operating Procedures (SOPs)

SOPs are paper workflows based on international guidelines [2] used to ensure a safe and appropriate transfusion practice. We considered the SOPs involved from the check-in of the patient tube to the BC release. There are seven main SOPs: 1) Transfusion request (TR) check-in, 2) TR registration, 3) Blood group determination, 4) BC

reservation (for red cells only), 5) Cross-testing (for red cells only), 6) BC assignment and 7) BC release. With the aim to cover the majority of the expected technical issues, we have also included guidelines based on our clinical practice.

1.2. EmoNet

EmoNet [3] is a management system built according to the standards UNI10529/ISBT128/CEN. The software is based on a multi-tier model with a clear separation between the presentation components, elaborative logic and access to the data network clients. It can be interfaced with several hospital information systems and allows the maximum traceability, working by continuous information cross-matching. The database supported is Oracle9 (Oracle 10g under development).

1.3. YAWL

YAWL (Yet Another Workflow Language) is an Open Source workflow management system based on the Web-service concept. Compared to those commercially available, YAWL shows greater expressiveness and a good flexibility due to the worklet service [4]. The YAWL system relies on a complete and new language with independent semantics inspired by Petri nets, which provides direct support for all the workflow patterns, has a formal semantics and offers a graphical representation for many of its concepts. A workflow specification in the YAWL language is a set of extended workflow nets (EWF nets) which form a hierarchical structure. The YAWL system is composed of the YAWL Editor, which permits the visual editing of definitions and the data they exploit, and by the YAWL Engine, which performs the workflows execution. The system supports the interconnection of external applications and services with the workflow execution engine using a service-oriented approach.

2. Results

Our workflow model involves two actors: the laboratory technician (T) and the Biologist/Medical Doctor (B/M). Most procedures are double checked. The B/M can execute and has the responsibility to validate the entire process. The higher level of the packed red blood cells management workflow (figure 1) is composed by atomic activities (the single-line boxes) or complex activities (double-line boxes), executed activating a sub-process. The process starts with the TR check-in (actor T), and, on urgency basis, it can continue with a standard management (the upper part) or an urgent management (the lower part). The standard management is a sequence of activities: TR registration (using EmoNet; actor T), blood group determination (laboratory activity; both), BC reservation (EmoNet; T), Cross-testing (lab. activity; both), BC assignment (EmoNet; B/M) and BC release (both), computer-based but also manually performed in selected cases. The management under urgency is more complex. The choice (implemented with the xor-split construct of YAWL) whether to perform the fastest release (0 type Rh negative units) or not is presented. If not, the blood group determination and TR registration are performed and a second choice is made. If the blood group of the patient is known, it is possible to reserve units of the same AB0 group and Rh-type; otherwise the system allows for reservation of 0 type units with positive or negative Rh according to the Rh-type of the patient. The process ends with a

BC computerized release. A similar process is defined also for Platelets and Plasma. The phases involving EmoNet are defined according to the manufacturer's manual. In order to improve the visual learning, every action is also showed through snapshots.

The system calculates the medium time spent before and after training. Moreover, considering that both the actors are often involved in parallel sessions, we defined sub-processes with parallel activities (YAWL's And-split and And-join constructs).

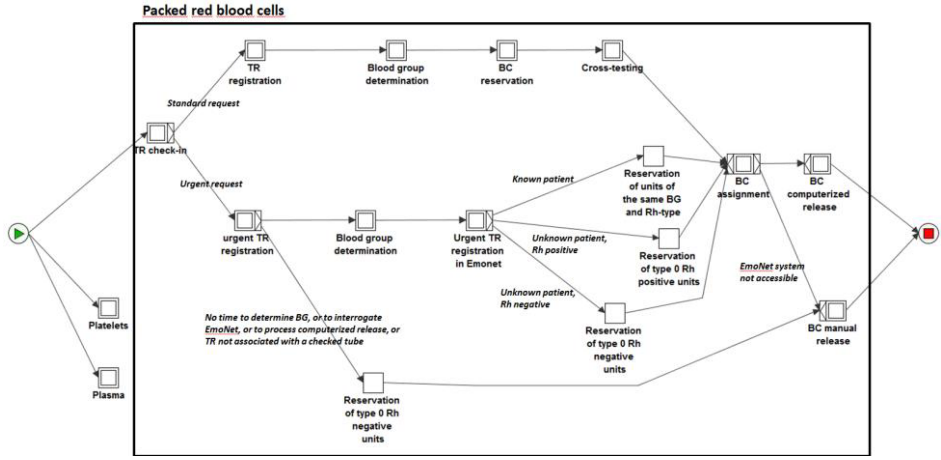

Figure 1. The packed red blood cells management process in YAWL.

3. Discussion

This tool organizes common technical procedures, inexpensive and widely available. Thanks to the YAWL's flexibility, it could be easily extended and customized in many ways for other hospitals (i.e. switching from EmoNet). A trial phase is still needed. With the aim to verify the improvement in our training program (e.g. higher efficiency of the training, lower incidence of technical errors leading to a faster high quality service), both the actors who are not ordinary in charge of the service, but, in turn and in emergency, could be responsible of the transfusion request, will be assisted by the tool in real time during simulations. In fact, since the system represents and explains all the activities to perform in order to release a BC, it can be used for training purposes (during real-time simulations) and, in the next future, during the routine activity in real time. The system's performance evaluation will be based on the results of the tutorial tests and of the questionnaires of satisfaction administered to the users.

References

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