User-centred, multidimensional assessment method of Clinical Information Systems: a case-study in anaesthesiology

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Summary This paper describes a multi-dimensional assessment method to support the choice and acquisition process for Clinical Information Systems. The method addresses three different dimensions: (1) Quality management, which evaluates the fulfilment of Users Requirements, and the Users' satisfaction with the existing functions; (2) Usability assessment, which includes a Usability inspection, and a Usability test; (3) Performance evaluation, which assesses the exhaustiveness and quality of documentation. The method is illustrated using the case study of a Clinical Information System (CIS) acquisition for anaesthesiology. It proved efficient and promising as a support for the decision process, for enhancing users' involvement in the project, and for initiating the necessary re-engineering of the Human Computer Interface.
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1. Introduction

More and more hospitals and health institutions now have to purchase their Medical Information System or components of these systems from the commercial products available on the market. Relying on a Users' Requirements Specification Document describing the functions of the future system, its context of use and the technical constraints for its implementation, the hospital managers issue a request for proposal (RFP). It is then necessary to analyse the bids properly in order to get the product that will best suit both the organisation and the users. However, a number of healthcare institutions have recognised the limitations of the analysis of paper-based answers provided by bidders, and currently try to introduce some kind of trial period into the acquisition process.

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This suggests that the decision process is not so easy, and needs to be supported with specific assessment methods. Such an early assessment, concomitant with the RFP and with the entire choice and decision process has to be both quantitative and qualitative. Hospital managers, stakeholders and users' representatives have to rely on clear numbers to justify the choice of an application and the final decision of buying and installing it. But they also need a deep qualitative analysis based on a clear understanding of the users' needs and of their current activity and work habits, into which the future application will be integrated [1,2]. In sum, they want three important questions to be addressed:

- does the application cover all the required functions? Do these functions meet the users requirements and more specifically the users' understanding of these requirements?
- are these functions and their corresponding Human-Computer Interface (HCI) usable in their daily working activity?
- is the application efficient enough for the required medical information management?

The assessment method must be designed to provide the hospital managers, stakeholders and users' representatives with reliable answers to these three questions, and the hospital should not buy nor install the product unless it meets minimum requirements in these three domains. Therefore, the evaluation process must aim both at supporting the choice of an application and also at ensuring the quality and adequacy of the selected product. The assessment method may also support the re-engineering process of the application if necessary.

In order to fulfil this specific need, we have developed a user-centred assessment method including three main dimensions:

(1) Quality management: it is important to ascertain that all the required functions are actually working, and that they meet the users' expectations.

(2) Usability assessment: it is a combination of usability inspection and usability testing. The introduction of Usability Engineering methods [3,4] in the choice and decision process has proven to be very efficient in helping all participants in a project reach a common and stable choice, based on a usability assessment of the bidders' applications [4,5]. Usability inspection and particularly heuristic evaluation [6] allow making sure that the application is intuitive enough, and will be easy to learn and to master, even in cases when numerous and various users may be expected. Usability tests [7] are the best way of assessing if an application is compatible with users' activity and with the cognitive and collaborative aspects of that activity in particular.

(3) Performance analysis: it is important for the users and the project managers to make sure that the application will allow at the least, as good a medical information management as the previous paper chart, and that the quality of the documentation will be just as good or improved.

We present here an illustration of such a user-centred multidimensional assessment method applied to the process of choosing a Clinical Information System (CIS) for anaesthesiology.

2. Context

The Lille Regional University Hospital is a 3000-bed capacity hospital. Its three departments of anaesthesiology comprise 25 consultation rooms, 100 anaesthetic sites, 110 beds distributed in 18 recovery rooms, and about 50 000 anaesthetics administered per year. In 2000, the hospital managers and the anaesthetists' representatives decided to acquire a CIS for anaesthesiology, in order to support the entire anaesthetic process: (i) the pre-operative phase, that is the anaesthetic consultation, which is a medical consultation performed about 1 week before the actual surgery, and the pre-anaesthetic visit, performed a day before surgery; (ii) the intra-operative phase, that is the induction, monitoring, and surveillance of the patient's status; (iii) the post-operative phase, that is the surveillance of the recovery phase. At the time, it was not clear whether such integrated Clinical Information Systems for Anaesthesiology were actually available on the market and/or if the existing products were reliable. Therefore, the project managers launched a special performance-based RFP including on-site tests and trials. This required the bidders to have their product installed and running on pilot sites for 2 months, in order to be able to assess the applications with real users and in real working situations. We present here the assessment methods used during the two on-site trials and the results obtained.

Although the complete study includes results for the three anaesthetic phases, in this paper, we focus on the pre-operative part of the process [2,8]. The intra-operative part of the Anaesthesiology CIS consists mainly of functions allowing the automatic recording of physiological data during the surgery.