Conceptual Design of a Personalised Tool for Remote Preanaesthesia Evaluation: A User-Centred Approach

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Abstract. This paper describes the key features of a tool for remote preanaesthesia evaluation. These features include the production of custom informative material and the provision of tailored support for preoperative follow-up. The tool is expected to yield significant results: improved efficiency (making better use of distributed resources), enhanced fairness to citizens and direct access to personalised information and advice.

Keywords: remote preanaesthesia evaluation, e-health, preoperative follow up, coordinated care, user-centred design, personalisation.

1 Introduction

The period preceding surgery (preoperative period) is critical for planning and implementing all steps required for minimizing risks in the operating theatre. "Preanaesthesia evaluation" is a set of activities aiming to review patient health status before the surgery is planned. The evaluation is performed to ensure that potentially threatening conditions are promptly identified and addressed. This paper presents the conceptual design of a specialised tool for remote preanaesthesia evaluation adopting a user-centred approach (UCD) i.e. an approach that maintains a clear focus on users' characteristics and the context of use. The ISO 13407 standard [1] defines UCD as "an approach to interactive systems development focusing specifically on making systems usable". The standard provides guidance on UCD activities throughout the development life cycle of computer-based systems. It identifies four principles: active user involvement and clear understanding of user and task requirements, appropriate function allocation between user and technology, iteration of design solutions, and multi-disciplinary design. Furthermore, it describes four key activities: understand the context of use, specify user and organisational requirements, produce design solutions, evaluate designs against requirements.

A personalised system adapts or allows adapting the system's content, structure, and functionality to users to accommodate the differences between individuals. There is a variety of system features classified as "personalisation", from simple display of the end-user's identity and personal preferences on the interface, to complex customization based on predictive models of users' behaviours. Similarly, personalization technologies range from commonplace use of databases, cookies, and dynamic page generation, to esoteric pattern matching and machine-learning algorithms, rule-based

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inference, and data mining [2]. Personalisability and design for personalisability can be viewed as aspects of design for user centeredness [3].

2 Preanaesthesia Evaluation and the Greek Islands Context

The American Society of Anaesthesiologists (ASA) defines Preanaesthesia Evaluation as "....the process of clinical assessment that precedes the delivery of anaesthesia for surgery and for non-surgical procedures" [4]. In general, patients are screened two days to one month before their scheduled date of surgery. The evaluation has three main purposes:

- Plan for the anaesthesia (e.g. medication and equipment to be used, additional staff during or after surgery, patient's postoperative recovery and pain management)
- Support overall hospital surgery scheduling and diminish last-minute changes
- Comfort and educate patient about the surgery, the anaesthesia and the preparations

The evaluation includes the assessment of information from several sources: patient interview, physical examination, laboratory tests and accessible medical records. Preanaesthesia evaluation is documented in special forms. There is no standard version of these forms and they can vary from free-text blank pages to be attached to the medical records to highly standardised electronic forms.

There are more than 200 inhabited islands in Greece and approximately 70% of them have a population of less than 100. In most islands the population is served by local “health centres”, staffed mainly by rural service medical doctors (young practitioners right after graduation). Properly equipped hospitals exist only in large islands. For all planned operations, patients from the islands visit the hospital some days ahead. During the visit, they undergo the preoperative evaluation which includes laboratory tests, patient interview, physical examination, and filling of the preanaesthesia evaluation forms. It is not uncommon to carry out the tests in the local “health centres” and send (prior to the patient visit) the results to the hospital in which the surgery is planned in order to save the patient a day of hospitalisation. Laboratory, electrocardiogram, and x-ray facilities are available on site for more than 80% of the island population. Nevertheless, there is no suitable infrastructure for performing remotely the patient interview and completing the special forms.

3 Usage Scenario

A typical usage scenario is illustrated in figure 1. The actors involved are the rural service doctor, the anaesthesiologist located remotely at the hospital and the patient. Action starts after the need for elective surgery is diagnosed. After that, all tests required are carried out and when the results are available the remote preanaesthesia evaluation takes place. The hospital anaesthesiologist directs the information collection process (similarly to what would happen during an in-situ patient interview and physical examination). The local doctor is mediating information collection ensuring the soundness of patient answers related to medical history, type of surgery expected, medical, surgical, anaesthetic and allergic antecedents, current medical treatment and current clinical state per system (e.g. respiratory, cardiovascular).

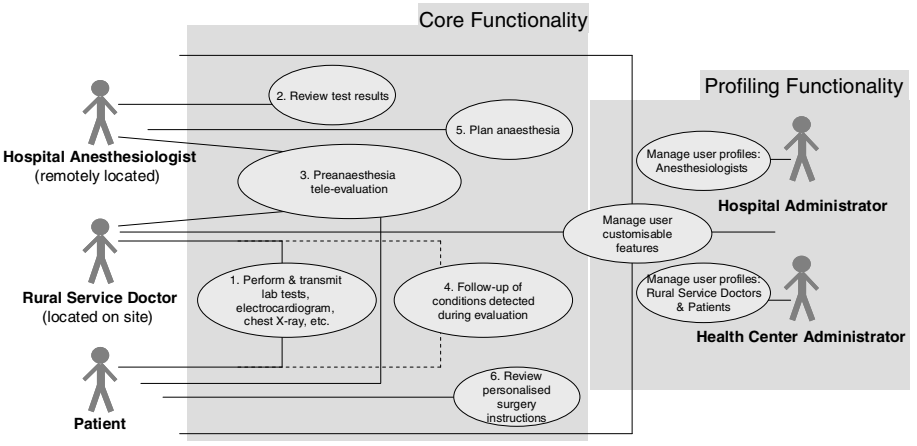

Fig. 1. The proposed functionality for the remote preanaesthesia evaluation tool

After feeding the application with all patient related information it produces specific personal preoperative instructions and information. This is not to be done automatically but rather, the application will produce standard content based on the specific patient information (surgery type, health status and demographics) and make it then available to the hospital doctor for editing. The level of sophistication envisaged at this moment for the tool is pretty basic and the content would be a selection of the typical brochure material ordered in a simple tree structure. Additionally, the tool is designed to include a diary-like printing option containing key milestones for the patient and a reminders' functionality for the local doctor (to be used for the follow-up of the medical conditions detected during evaluation). We expect to build upon the material entered by doctors at a later stage in order to construct a refined authoring functionality (refer to [5] for advanced work on formal learning models allowing surgeons to input purpose-specific and patient-specific text which is then assembled by a tailoring engine into patient-specific material).

Both verbal and written communication is foreseen: the verbal mode provides quicker and richer responses, whereas the written mode is mandatory for recording critical information exchanged. Structured and free text input is allowed as the patient specific descriptions cannot always fit in standard fields. The standardised data elements are mainly required for classification, reporting and statistical purposes while the rich textual information is fully usable as part of the patient medical record.

The functionality dedicated to profiles management enables administration of information, preferences and rules and ensures security and confidentiality. The aim is to provide adaptive and personalised content and interface. Furthermore, given the sensitive character of health related information and legal issues related to medical advice, personalised access ensures that information will not be revealed to any unauthorised party and will be protected from illicit modification and deletion.

4 Discussion

In the present work we demonstrate the key features of a preanaesthesia tele-evaluation tool that enables personalised information access and can support follow-up during the whole preoperative period. The aim is not to automate and trivialise the evaluation but rather to enhance coordinated and personalised health care improving the efficiency of use of all resources available. Although there is a significant trend towards standardisation we believe that there are more benefits to reap leveraging technology to achieve personalisation and agility. There is evidence ([6], [7]) that patient engagement and compliance with medical regimens improves significantly when informative material is customised for their individual needs. Providing appropriate information to patients before surgery has been demonstrated to lead to reduced hospital stays ([5], [8], [9]), combining this with ameliorated and closely followed preoperative care is expected to produce patients who require less days of preoperative hospitalisation and are ready to leave the hospital earlier as it further reduces surgery risks. Future work is expected to focus on overcoming organisational difficulties, improving the simple recommendation algorithms proposed for content delivery and testing our research hypothesis about the tool results (reduced hospital days, better coordination and continuity of care).

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