

## Computerization of a Preanesthetic Evaluation and User satisfaction evaluation

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### Abstract

*Preanesthetic evaluation purpose is to reduce morbidity and mortality through the review of the patient's medical history, clinical examination, and targeted clinical studies, providing referrals for medical consultations when appropriated. Changes in patient care, standards of health information management and patterns of perioperative care, have resulted in a re-conceptualization of this process where the documentation of patient medical information, the efforts in training and maintaining the integrity of the medical-legal evaluation are areas of concern. The aim of this paper is to describe the design, development, training, and implementation of a computerized preanesthetic evaluation form associated to the evaluation of the user satisfaction with the system. Since the system went live in September 2008 there were 15121 closed structured forms, 60% for ambulatory procedures and 40 % for procedures that required hospital admission. 82% of total closed structured forms had recorded a risk of the procedures of 1-2, according to the American Society of Anesthesiologists classification. The survey indicates a positive general satisfaction of the users with the system.*

### Keywords:

Preoperative care, Computerized medical records systems, Perioperative procedures, User satisfaction

### Introduction

Preanesthetic evaluation is a clinical assessment process that precedes the accomplishment of surgical and non surgical procedures, which will be carried out under general or local anesthesia or sedation. This process includes review of the medical records of the patient, current medical history, clinical examination, test results and referrals to other specialists when appropriate[1]. The purpose of the evaluation is to reduce preoperative morbidity and mortality [2]. The detection of risk factors influences the choice of the anesthetic technique, the complexity of required actions and the need of specific anesthetic postoperative care [3].

Changes in patient care, standards of health information management and patterns of perioperative care, have resulted in a

re-conceptualization of every aspect of preoperative preparation, where the documentation of patient medical information, the efforts in training and maintaining the integrity of the medical-legal evaluation in preanesthetic are areas of concern and research [4, 5]. The registration of this assessment is often done on paper.

A study compared the efficiency of a new computerized preoperative evaluation system against one paper based and the waiting and examination periods were analyzed. The computerized system required less examination time than the manual system and the authors presumed that time is saved at other points of patient care by the legible, instantly retrievable preoperative evaluations that the computerized system produces. The computerization of clinical records improves the quality of patient care by transforming this information into data which is easily readable and accessible [6, 7].

The implementation of a computerized version of a structured Preanesthetic evaluation questionnaire in obstetric patients reduced time-consuming tasks, captured far more detail and provided immediately available data for quality assurance activities[8].

The purposes of this study are 1) to describe the design, development, training and implementation of a Preanesthetic Evaluation Electronic Form (PEEF) included in an Electronic Health Record (EHR), 2) results of system use since implementation and 3) to assess the user satisfaction with the new system. This is done within the framework of a new Center for Preanesthetic Evaluation (PEC) in the Hospital Italiano of Buenos Aires.

### Materials and Methods

#### Design

This is a descriptive study of a Preanesthetic Evaluation Electronic Form implementation.

#### Setting

The Hospital Italiano of Buenos Aires (HIBA) is a non-profit health care academic center founded in 1853. HIBA has a network of two hospitals with 750 beds, 500 home care pa-

tients under care, and 23 outpatient care centers. There are more than 2,400,000 outpatient visits annually, each year over 38,000 inpatients are admitted to its hospitals and 23,000 surgeries in the last year.

In 1998 HIBA began the implementation of a Healthcare Information System (HIS) to manage clinical information with preexisting administrative applications. It is an in-house project that currently handles all the information related to health care both clinical and administrative from capture to analysis.

The EHR is a full-implemented web based, problem oriented, patient centered record with customized functionalities depending on the level of care (outpatient, inpatient, emergency care and home care) This EHR system includes a computerized provider order entry (CPOE), available throughout the HIBA network. The terminology server [9, 10] has allowed the mapping of local vocabulary (thesaurus) to reference vocabulary SNOMED CT, allowing the auto-codification of 80 % of diagnosis.

**Computerization of the preoperative process**

The computerization of the preoperative process was planned and included the following stages: the computerization of the Preanesthetic Evaluation Form, the appointment for surgery, and the Surgery & Anesthesia Form. In addition to this, and in the context of the proposed creation of the PEC, a multi-disciplinary working team was established enabling the development of the PEEF (Figure 1).

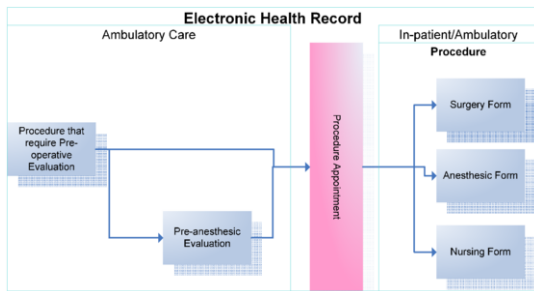


Figure 1- Computerization of the preoperative process

**Multi-disciplinary working team**

An anesthesiologist, a pediatrician, a clinician, a cardiologist, norms and procedures area specialist and two medical informatics residents integrated the working team. The medical informaticians were in charge of preparing the functional requirements, the implementation and user satisfaction survey using QUIS™.

**Evaluation Process pre go live**

The Preanesthetic Evaluation (PE) for adults and pediatric populations was carried out in HIBA in a decentralized manner in several locations, with different methods of coordination and evaluation. An average of 1500 patients per month was evaluated.

The PE began with the ordering of a surgical procedure or any other that is carried out under anesthesia. To record the steps during the evaluation, a paper form was used. This form was given to the patient, in the majority of cases by clerks during scheduled visits or by the surgeon’s secretaries that was going to execute the procedure.

The paper form had specific data fields, depending on the circumstances. It was completed by the patient, the clerk or the secretary, the clinician, the cardiologist, the anesthesiologist and the nurse.

Finally, the form consisted of a summary generated through the participation of multiple key users involved. Sometimes, the records were illegible. Anesthesiologists highlighted the most important data evaluated in the paper so that the anesthesiologist at the operating room could quickly visualize it. At that time a copy was given to the patient with the fasting schedule, the preparation for surgery, the procedure explanation and an informed consent.

**Preanesthetic Evaluation Electronic Form (PEEF)**

The PEEF was included in the ambulatory EHR (AEHR) and was developed entirely in Java.

Every PEEF starts with the input of the problem or a procedure coded by the terminology server [10, 11]. While the PEEF is opened the user can navigate between modules and add or modify information, when the PEEF is closed the final print version of the structured form could be given to the patient with the highlighted data chosen by the physician.

This new structured form was divided into the following sections or modules:

- **Relevant Diseases:** there is a predefined list of diseases and pathologies, as shown in Figure 2. If any of these were already in the problem list of the AEHR, it automatically appears highlighted (underlined) in this module. This helps to avoid duplication of information and enabled integration of a structured data into a longitudinal patient record. Also contains the vital signs and tetanus immunization data.

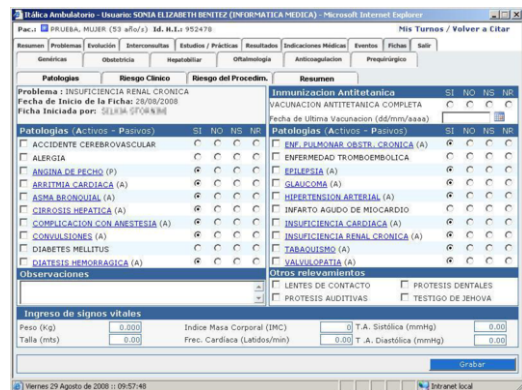


Figure 2- Snapshot of the EHR: pre-defined relevant diseases list in the Preanesthetic Evaluation Electronic Form.

- Clinical risk: in this section clinical, respiratory and renal risk is evaluated; laboratory test can be ordered; referral can be made as well as to order the medication suspension. If respiratory risk is marked an alert suggesting ordering a test is triggered (Figure 3)

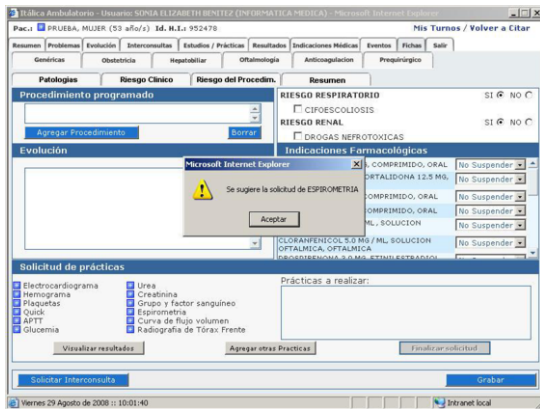


Figure 3- Snapshot of the EHR: Section for Clinical Risk evaluation in the Preanesthetic Evaluation Electronic Form.

- Risks of the procedure: the risk of bleeding and the difficulty on intubation is evaluated by the anesthesiologist. The result of this is expressed using the ASA (American Society of Anesthesiologists) score.
- Summary: In this module all the records made are visible in a summarized form.

**Training in the use of the PEEF**

During the pre go live stage a virtual training space was created and online reading material was made available to the users. The training course had interactive material and assessment activities. The implementation process was accompanied by a face to face support made by medical informatics residents.

**Databases analysis**

Secondary databases were analyzed to evaluate the amount of PEEF created and closed, the most frequent diagnosis and procedure and the prevailing ASA classification.

The ASA Score is a five category physical status classification system for evaluating a patient before surgery. The categories are: 1)The healthy patient, 2)The patient with mild systemic disease, 3) The patient with severe systemic disease, 4) The patient with severe systemic disease that is a constant threat to life 5) The patient who is not expected to survive without the operation.

**QUIS: Evaluation of User Satisfaction**

The Questionnaire for User Interaction Satisfaction (QUIS™)[12] is a standardized usability testing instrument for interactive computer systems. An adapted Spanish edition of the short version was used supplemented by free-text comments.

The survey contains a demographic questionnaire with the identification of the physician specialty, a measure of general satisfaction and an organized evaluation of four specific interface factors: screen, terminology and system feedback, learning, and system capabilities. The global satisfaction with the interface are measured, as well as the factors that are part of that aspect, on a 9-point scale, where 1 (one) correspond to the worst and 9 (nine) characterize the best evaluation.

When the survey was completed, each area was analyzed separately and grouped by medical specialties. Central tendency of data was summarized by the median and the dispersion by range.

**Results**

**Databases analysis**

Since the system went live in September 2008 there were 15121 closed structured forms, 60% for ambulatory procedures and 40 % for procedures that will require hospital admittance. The prevailing ASA was 1-2 with 82% of total closed structured forms.

Currently 20 general practitioners (GP), 5 anesthesiologists and a variable number of cardiologists are working in the Center.

**Evaluation of User Satisfaction**

Between 29/09/09 and 10/10/09, 18 users completed the survey. 66 % of them have been working with the system between 6 month up to a year and 53 % worked between 4 hs. to 10 hs. 61% of users who completed the survey were general practitioner with a response rate of 55% and the 16 % corresponding to anesthesiologists with a response rate of 60%.

QUIS categories were compared between the user’s specialties as shown in Table 1.

Table 1 - Results of Category<sup>1</sup>

Categories	GP	Anesthesiologist	Global Median
General Satisfaction	7 (5-8)	7 (3-8)	7
Learning	8 (7-9)	8 (8-9)	8
Screen design	8 (7-9)	8 (7-9)	8
Use of terminology	7,5 (6-8)	7,5 (7-9)	7,5
Capacity of system	7 (6-7,5)	8 (8)	7,5
Users manuals & Help desk	7 (6-8)	7 (6,5-8)	7

Due to the variability number of the cardiologist that used the form, they were not included.

The majority of items were scored up to 7, except two items of General satisfaction (Flexibility and Adequacy of power) and

<sup>1</sup> The results of Table 2 related to GP and Anesthesiologist are expressed in median (range).

one item of Help desk & user manual (Clarity of User Manual) as is shown in Figure 4.

Learning to use PEEF was appraised as easy by the anesthesiologists.

Characters on the screen were easy to read and sequence of screen was considered very clear. Anesthesiologists rated more positively the system's capabilities in contrast with GPs. The help desk service was helpful and the support more appreciated for both GP and Anesthesiologists.

**Free-Text Opinion Space**

In addition to the above mentioned 71% (10/14) of the physicians who completed the questionnaire also contributed with narrative responses about different problems or features of the PEEF. The problems mentioned were the downtime of the system, problems and procedures correction, rigidity of tetanus vaccination data entry and medication suspension. Alerts and more amount of free text were solicited, among others.

Three of the cardiologists wrote their opinion. Only one of them asked about a specific section for cardiologists' record.

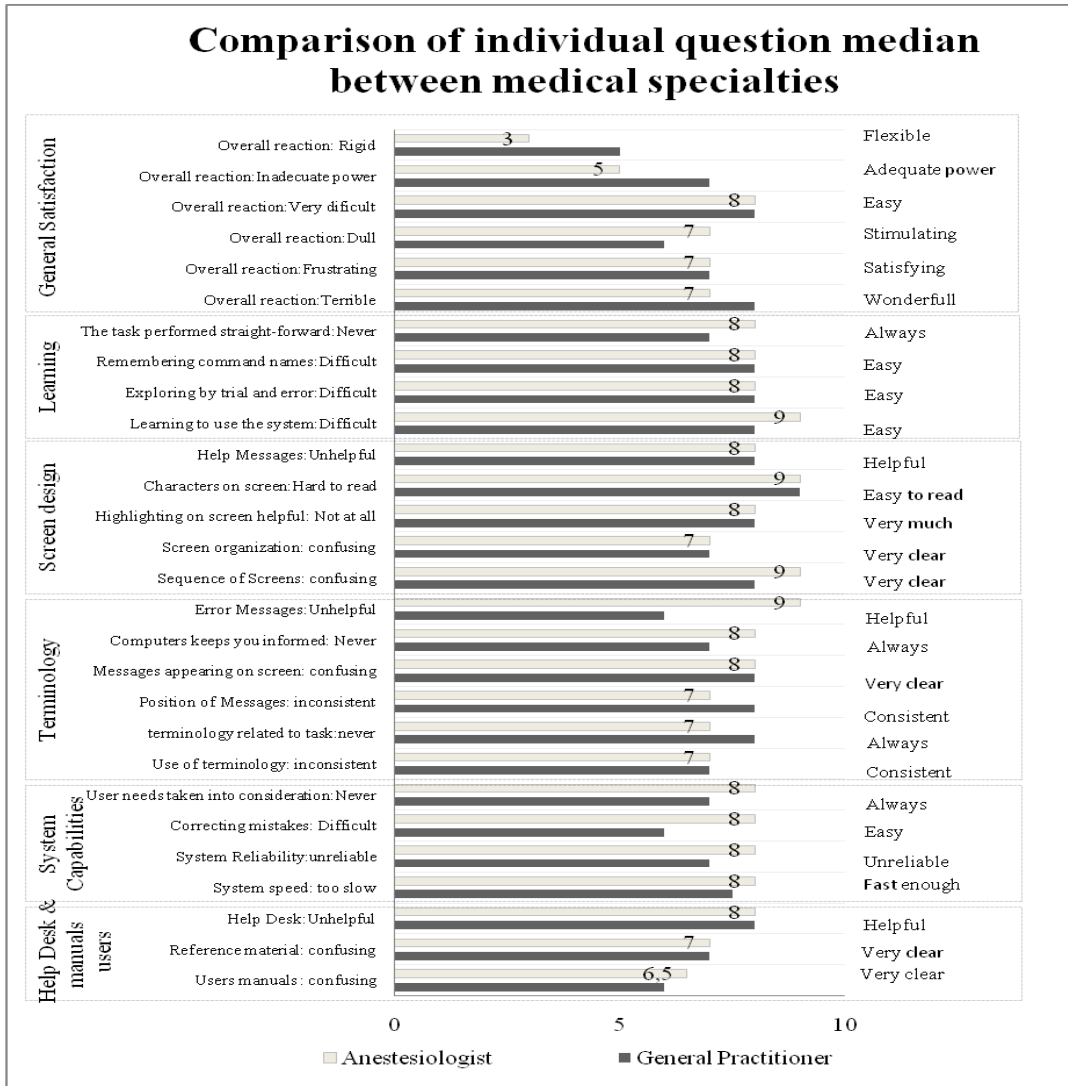


Figure 4 – Comparison of individual question median between medical specialties

## Discussion

In this study we described the experience of the implementation of an integrated computerized preanesthetic evaluation form in an academic center and the evaluation of user satisfaction of the new form.

User interface of systems has been evaluated by QUIST™ in other opportunities. Using QUIST™, 75 primary care physicians were surveyed about the Brigham and Women's Integrated Computing System (BICS). The system scored highest in the area of screen design and lowest in the area of system capability. General satisfaction was most highly correlated with screen design and layout [13]. Also was the instrument used for comparing the physician satisfaction with two order entry systems. User satisfaction differed significantly between the two systems, the Veterans Affairs CPRS had a mean of 7,06 in General Satisfaction against the Commercial System evaluated [14].

The survey results indicated a positive general satisfaction on the PEEF. It scored highest particularly in the area of screen design. The system was globally considered as stimulating, with adequate capacity and ease of use.

The lack of flexibility expressed in the results is associated to a pre-defined list of problem and rigidity of tetanus vaccination data entry and medication suspension

The limitation of this user survey can be summarized in the following points: the overall response rate was low and the cardiologists were not included due to the variability of number of them.

## Conclusion

A PEEF was successfully implemented, used and accepted by the end user.

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