Designing the User Interface for an Online Nursing Assessment System

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Abstract—This paper presents a design of an online nurse assessment system for use across a southern Brazil hospital complex. A prototype was built and tested, using a user centered interface design process. Design experts and nurses from an American hospital evaluated the prototype through heuristic and scenario analysis. The results show some consistency and clarity problems within the prototype, but overall acceptance of it. The prototype can be used in the future as a foundation for further development of electronic nursing assessment systems.

I. INTRODUCTION

This paper discusses the design of a user interface for an online nursing assessment system, with special attention paid to the application of utility and usability concepts. Specifically, the paper-based nursing assessment form of a Brazilian hospital was converted to an interactive online system by an international student team, working with a Brazilian and an American university. The nursing assessment is the first phase of the nursing care process, for gathering patient information (as relevant to the nurses). The focus of the nursing assessment is to collect information to identify patient needs and cares, while in medical process the center of attention is the pathology treatment [1]. The assessment documents patient information, such as habits and physical and mental conditions, each time the patient enters a ward. It leads to the nursing diagnosis, establishes priorities in patient care, and should be concise and individualized, regardless of the patient case [2, 3, 4]. This information is further analyzed by other physicians, including patient doctor.

Much inefficiency exists with the current, paper-based assessment system. For example, the same information is often gathered several times for each patient as they move between wards. In a similar fashion, compiling the information from different wards is difficult, and leads to data inconsistencies and replication. The online system in this project was developed to streamline and standardize the collection of patient information through user centered interface design [5, 6], aiming to increase the use of the assessment form and to reduce time consumption.

II. METHODS

The project was divided into three main stages, corresponding to the initial steps of the user centered interface design process [7, 8]: (A) analysis of the original system, (B) development of a prototype, and (C) prototype evaluation. The team completed stage A in Brazil and stages B and C in the United States.

To analyze the original system, the team held meetings with various nurses from the local hospital complex in Porto Alegre, Brazil as well as medical system designers. These meetings were conducted once per week for two hours on average, always with at least one nurse and one medical system designer. In these meetings, through informal interviews, the team sought to understand everything related to inpatient nursing assessment, including: tasks, environment, mental models [9], and current and past systems. In particular, the team extensively discussed the current paper assessment form with the nurses, attempting to understand the purpose, placement, and expected results of each component.

In order to design and develop the prototype of the online nursing assessment system, the team held meetings at least once per week for two months. These meetings consisted of extensive brainstorming among the team members and an interface expert. The team then discussed how to integrate the diverse ideas, knowledge, research, and requirements. The team completed this integration by creating hypothetical screenshots of the prototype in Microsoft Visio®.

The third and final stage, evaluation, began with several
iterations of heuristic evaluations from the team members and an interface expert, followed by a cognitive walkthrough and small scale usability studies with practicing nurses. Seven University of Virginia doctoral nursing students, divided into four groups, performed these latter evaluations. Each group, which was supervised by one team member, completed six scenarios with interactive Microsoft Powerpoint® files containing the designed screens. During these scenarios, the team members asked participants to explain their thoughts. After each scenario, the nurses explained their thoughts in more detail and completed a corresponding questionnaire, which focused primarily on functionality and aesthetics. In addition, several Brazilian nurses with experience in interface design for medical systems were sent, by email, the same test performed by nurses in the United States. These nurses participated actively in the first stage of this project and evaluated the interface heuristically and as a potential user.

III. RESULTS

The results of this project are divided into three stages: analyses of the original system, development of a prototype, and prototype evaluation.

A. Analysis of the original system

The original paper based nursing assessment in use throughout a complex of hospitals in Porto Alegre was the end result of several years of collaborative discussions between nurses representing each hospital. At one time, each of these hospitals had a different nursing assessment form. These differences were refined through the development of the current standard form, agreed upon to contain only the most important elements of an initial patient nursing assessment. These elements are represented as a series of questions describing the current status of the patient with regard to the following categories: identification, disease and treatment, habits, psychosocial, physical exam, and organs and systems.

Most of the questions in the assessment include open response fields, which engender nonstandard answers from nurses unfamiliar with technical medical terminology. Also, most of these questions are considered obligatory, but there is no way to make sure that nurses answer them. Some of the questions only apply to specific types of patients, such as respiratory patients, whereas the majority of the questions apply to every patient, regardless of type. The paper version involves significant amounts of rework, since the same basic patient information is gathered each time the patient changes wards.

B. Development of a prototype

1) Comparative analysis

Once an understanding of the original system was reached, its content and design were compared with the content and design of other existing systems. Verification that the elements contained in the paper version were indeed the needed elements for a nursing assessment was the crucial step toward establishing the utility of the original system and of the future online system. This verification was accomplished through interviews with the nurses as well as comparative analyses between the original system and other paper based nursing assessments.

To further prepare for the design phase, the team researched several preexisting online medical assessment systems as well as other paper based nursing assessment forms. This research resulted in an understanding of the best practices of interface design principles currently in use in the industry. Many design ideas, ranging from overall interface formats and appearances to detailed data input fields, were considered for the prototype design.

2) Prototype design and construction

The team was initially divided into two groups. Each group separately developed their own preliminary interface. These first interfaces came from the learning of the previous research and did not comprise the whole system, but only some main pages of the nurse assessment form. One of the groups created the interface as shown in Figure 2, and the other group developed the interface shown in the Figure 3. The team was divided into two groups because, by working separately, they developed independent ideas for the
interface, using the results of the comparative analyses as inspiration.

These two initial design ideas for the nursing assessment online user interface were then compiled into a unique interface, as shown in Figure 4. The resultant preliminary interface was expected to join the best aspects of each one of the two first design ideas.

After compiling the ideas, the team worked to improve this interface. In order to design the interface according to the user needs, the previous and the preliminary interfaces were based on the paper-based version of the assessment form. All the sections were kept the same as in the original form, and in the same order of completion.

The new system was designed in a way which would provide guidance to the user (e.g., progress is shown by
filling in the circles to the left of each menu item as users complete the forms) [9].

The result of this process was a prototype of the interface. It was built through Microsoft PowerPoint®, using screenshots of the interface built in Microsoft Visio®. The prototype had the basic functionalities in a semi-interactive design that enabled a test user to complete the task requirements of a small scale usability scenario.

C. Prototype evaluation

The prototype design was initially presented to several experts in interface design, who provided preliminary feedback through inspection of various screenshots. Adjustments were continuously made to the prototype, resulting in a partially functional interactive set of mockup designs. This mockup was put through a series of heuristic evaluations and small scale usability studies using seven PhD nursing students as test subjects. Each participant was guided through several cognitive walkthroughs by way of scenarios in order to obtain preliminary heuristic evaluation results.

For example, one scenario asked the participant to add ‘milk’ to the list of patient allergies, located in the Disease and Treatment section of the assessment tab. This meant that the participant needed to navigate to the assessment tab, in particular the Disease and Treatment section, from the patient Summary tab, and then successfully manipulate the data entry field to add ‘milk’ to the current list of allergies, and complete the scenario by saving the changes.

The participant was asked to talk aloud during each scenario, as well as to answer written questions regarding each scenario. These questions sought the participant’s opinion regarding the ease of use, intuitiveness, efficiency, appearance, and functionality of the user interface.

Additionally, several nursing experts in interface design, in Brazil, were sent the same test and questionnaire. As potential users (nurses), their feedback was used to certify that the interface designed in this project is a suitable representation of the paper based nursing assessment system; and, as experts in user interface design, they also provide a heuristic evaluation.

The results of this preliminary evaluation, as shown in Figures 5 and 6, affirm the overall format and navigation of the prototype design, with test participants scoring the interface design reasonably high on both appearance and functionality.

The test participants also suggested several possible improvements in more specific features such as the data entry field design and which set of patient attributes are always visible in the page header. It was also noted by the test participants that there were too many colors in the interface, and that obligatory fields needed to be indicated as such. The results of these heuristic evaluations can be seen in Figure 7.

One major finding of the usability walkthrough was the lack of understanding surrounding the ‘add’ functionality on the assessment pages. As seen in Figure 8, many assessment questions, such as ‘Allergies’ in the interface design asked
the user to input a specific patient allergy, such as ‘milk,’
but then to click the ‘add’ button to add the allergy to a list
of current patient allergies on the right hand side of the
screen. To finish the task, the user should click the ‘save
changes’ button at the bottom of the screen. The problem
arose because the users did not know to click the ‘add’
button – they simply typed in ‘milk’ and then tried to ‘save
changes’ without ‘adding’ the allergy to the list of allergies.
The users did not notice that the column to the right of the
screen listed the current patient conditions. This problem
needs to be readdressed through redesign and further
usability testing.

![Fig. 8 The disease and treatment page of the assessment](image)

**IV. CONCLUSION/FUTURE WORK**

This project has so far resulted in the design, production,
and evaluation of an online, prototype nursing assessment
system. Based on encouraging results from the evaluation,
future work can involve implementing ideas from the
evaluation, conducting formal usability tests on the intended
users, and building of an actual system.

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**REFERENCES**


