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User-Centered Design Practices to Redesign a Nursing e-Chart in Line with the Nursing Process

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Abstract. Regarding the user-centered design (UCD) practices carried out at Hospital Italiano of Buenos Aires, nursing e-chart user interface was redesigned in order to improve records` quality of nursing process based on an adapted Virginia Henderson theoretical model and patient safety standards to fulfil Joint Commission accreditation requirements. UCD practices were applied as standardized and recommended for electronic medical records usability evaluation. Implementation of these practices yielded a series of prototypes in 5 iterative cycles of incremental improvements to achieve goals of usability which were used and perceived as satisfactory by general care nurses. Nurses` involvement allowed balance between their needs and institution requirements.

Keywords: nursing record, nurse e-chart, user-centered design, user interface design, nursing process

1. Introduction

As health care organizations evolved from record paper based to electronic clinical record systems, representation of nursing data in formats that can be shared preserving its complexity, context, and richness of patient's care has become one major challenge [1]. Multiple nursing vocabularies are required to represent the variation which exists through practice domains and levels of care, in addition to formal coordination rules that support the representation of more complex concepts [2-3]. The UCD considers user's requirements in all phases of the design process of a product, generating more 'usable' tools [4]. Health Informatics Department of Hospital Italiano de Buenos Aires (HIBA) has implemented a process of UCD, establishing new rules and procedures for information systems design and evaluation, as recommended by Eric Schaffer [5] and the National Institute of Standards and Technology (NIST) to standardize the usability evaluation protocol of electronic health records [6]. To improve the quality of nursing records a redesign of the user interface was decided following the nursing process and Virginia Henderson model adapted to our hospital and the standards for patient safety aligned to Joint Commission International (JCI) accreditation process.

The aim of this study is to describe the participatory redesign of the nursing e-chart user interface at Hospital Italiano de Buenos Aires.

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2. Methods

This study was conducted at HIBA from March to July of 2014. The hospital was founded in 1853 and it belongs to a nonprofit health care network that includes a second hospital, 25 outpatient centers and 150 private offices distributed in the city of Buenos Aires. It has its own electronic health record (EHR). For inpatient, emergency room and home care areas a nurse e-chart is visible and accessible. At the moment of this study the nursing record was organized in 4 sections: Assessment, Planning, Implementation and Evaluation. Where each section is independent of each other, so nurses can record following the logic of nursing process or directly access any section without going through the others.

With regard to UCD framework, design of new nurse e-chart user interface was addressed with the following work plan outlined in table 1:

Table 1: Work plan for the design of new nurse e-chart user interface

Work plan	Actions
Nursing record assessment	Content evaluation Nurse-system interaction Usability defects Navigation
Contextual interview	Observation of EHR Nurses' interviews
Focus group	10 nurses Experiences related with care process documentation
Participatory design	Design sessions Informaticians and usability experts participation
Usability testing	5 iterative cycles Usability objetives: 1. Select pain and risks assessments according to needs. 2. Choose a nursing diagnosis, or add a new one, relevant with assessed findings. 3. Plan actions aimed to resolve the diagnostic cause. 4. Register planned actions execution. 5. Conduct an evaluation selecting one or more diagnoses. 6. Expressing satisfaction with the new interface.
Sample	Inclusion: General care nurses, Inpatient areas, both gender, no age limit Exclusion: Administrators and auxiliary nurses
Tests	Acoustically isolated room. Notebook DELL Latitude E5510 Balsamiq® mockups , Morae 3.2 (TechSmith Corporation) Paper prototypes with Carolyn Snyder methodology[9] Clinical case as trigger Final Interviews: nurses' tool perception and feasibility of application

We carried out, in several team meetings, brainstorming sessions, tasks analysis and nursing workflow, review of the literature [7-8], and analysis of Nurses Department requirements. Looking for usability and navigation defects we observed several nurses at their work environments in interaction with EHR, interviewing five of them. A focus group session was held with 10 nurses with a bachelor's degree or studies in progress.

In the first phase we developed the interface prototype, then the nutrition needs, pain and risks assessments considering the nursing process (NP) five stages. Using a

clinical case, paper-based tests were conducted with 13 nurses, aged 26 - 52 years, and more than half of them have been using the EHR for more than 5 years. After each test, a survey was conducted to each participant and iterative improvements were implemented in prototypes for new testing.

3. Results

The most important changes and modification to prior nursing record is given in sections of assessment, diagnoses and planning (in the same interface); the introduction of nursing diagnoses according to NANDA-I taxonomy II, Nursing Outcomes Classification (NOC) and Nursing Interventions Classification (NIC), and the evaluation according to nursing diagnoses. In the final version the NOC were removed (Figure 1).

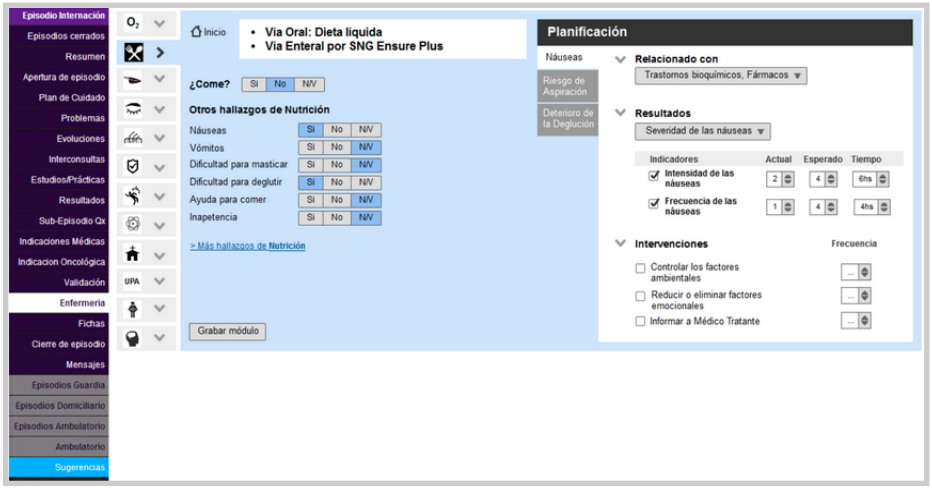

Figure 1: Assessment and Planification screen prototype [9]

3.1. User evaluation

The focus group and nurses' interviews showed that nurse-patient ratio (1:7 - 1:10 in general care areas), workflow, workload and number of computers available, impact on the quantity and quality of documentation. The nurses who participated in the tests described their relationship with technology as 'good enough'. We observed that nurses were inclined to write data in the evaluation section that should be written in others sections (assessment or execution), duplicating information. Once they have chosen the nursing diagnosis they were disoriented about etiology and outcomes. Also we observed they decided not to perform the ulcer pressure assessment risk based on assumptions and not on scales application. Repeatedly they were looking for free-text entry spaces to record even if not engage with the required information, and most reported using paper notes as memory aid. Sections that resulted in major questions

were those of diagnosis and assessment. During testing, the nurses preferred to record in the evaluation section that allows free-text because 'it is easier and faster'. They also expressed that would be useful to locate pain in a human figure and have reminders of reassessment for those patients who in initial assessments have been classified as 'low risk.

The perception regarding the new interface, information, navigation and content organization was satisfactory. Some mentions were that: would register more complete and accurate the nursing process avoiding the omission of data; that it would be simple to use with brief training, and the frequencies of planification for the NIC were not congruent with nurse-patient ratio and the availability of time, being this the most worrying aspect.

4. Discussion

We describe UCD practices to redesign the nurse e-chart user interface in order to improve the quality of the NP documentation. The impact of changing from a model that allows documentation ignoring the logic of the NP to a sequential model that implies choosing diagnoses and structure record requires a mental abstraction process and decision making that nurses identify in their mental process but fail to express in the documentation, generating tensions. But most acknowledged that 'they had studied it (NP) at undergraduate school'. Also that the new system was 'understandable' and with proper training would not have difficulties to use it. Considering the potential organizational impact caused by the new record, including all changes set to meet JCI accreditation process, we decided to remove the NOC because of lack of experience on using it and the complexity in the use.

One of the problems associated with electronic nursing records related to little involvement of nurses in the development of systems [10], aspect that we consider has been mitigated in this experience by applying the philosophy of the UCD and usability, considering represents one of the ways to address the use of a new system to increase adoption and determine the needs and preferences of end users [11].

Other experiences agreed with our findings, as long as a system is designed from the nurses' perspective, who consider the characteristics of their practice and project them on the content and functionality of the user interfaces, and is consistent with the sequence of evaluations of the patients that nurses perform, accompanying the mental process, planning of care and clinical judgment it is more likely to support the nursing work [12-13]. We must consider that this experience was performed with general inpatient care nurses. Future phases contemplate to replicate these practices with nurses in critical areas, neonatology, pediatrics and other special populations (mental health).

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