Nurses’ Notes Support System

By

Leo O. Vélez Ramos

A thesis proposal submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

COMPUTER ENGINEERING

UNIVERSITY OF PUERTO RICO
MAYAGÜEZ CAMPUS
1997

Approved by:

_____________________________ __________________
Néstor Rodríguez, Ph. D. Date
Member, Graduate Committee

_____________________________ __________________
Manuel A. Pérez, D.Sc. Date
Member, Graduate Committee

_____________________________ __________________
José A. Borges, Ph. D. Date
President, Graduate Committee

_____________________________ __________________
Samuel Irizarry, Ph. D. Date
Chairperson of the Department

_____________________________ __________________
Nelia Acosta, Ph. D. Date
Director of Graduate Studies
Justification

In any healthcare institution the nurse’s role is critical for promoting the well being of patients. The successful rehabilitation of a patient depends, to a great extend, on the quality of the care services received, most of which are provided by nurses. Thus, it is imperative that nurses dedicate as much time as possible to the continuous care of their patients.

In addition to providing proper patient care, the nurse must engage onto a series of other activities. Foremost among these is the process of nursing documentation. Now more than ever before, nurses are aware of the need to document nursing care [Taylor89]. Legally speaking, a nursing action not documented is a nursing action not performed. Therefore, nurses are compelled to write down all their interventions with patients, in order to keep record of all the details associated with their condition.

Documentation tasks can account for more than 30% of a nurse’s work shift, which limits the time that can be effectively used for direct patient caring. Computerized Patient Records (CPR) [Lundy96] as well as other nursing information systems (NIS) have come a long way in reducing the time spent by nurses on documentation tasks. However, these systems provide little or no support in two critical areas of the nursing process: nursing diagnoses and patient care plans.

Nursing Diagnoses are the product of assessing the health needs of a patient. That is, based on the collection and analysis of relevant patient information (symptoms, vital signs, etc.) the nurse identifies areas in which (nursing) intervention is required [Witter83]. The major
challenge that nurses face today is that of identifying the specific nursing diagnoses for those patients under their care, along with the incorporation of these diagnoses into the patients’ plan of care. Performing this kind of assessment can be difficult, due to the large number of nursing diagnoses in acceptance today.

The formulation of a nursing diagnosis can be a routine task for the experienced nurse. However, less experienced nurses (i.e. recent graduates) will generally take longer (and often encounter difficulties) in the assessment of a given patient. This is due to the fact that nurses need to become familiar with (at least) the most commonly used nursing diagnoses in their clinical setting.

The majority of hospitals have failed to provide any sort of methodology capable of supporting the formulation of nursing diagnoses. Rather, the nurse must rely on her knowledge of the field, along with any previously gathered experience, in order to come up with the most accurate and reliable diagnosis for a given patient. Nursing diagnosis manuals [Lyer86] are the only major source from which accurate diagnoses can be drawn. However, the large number of diagnoses included in these manuals\(^1\) can make it difficult for the nurse to choose the most appropriate one. Also, the fact that many different diagnoses can be related to one single sign/symptom leaves the nurse with a fairly large subset of diagnoses from which to choose. Thus it becomes imperative to investigate new ways of assisting the nurse in this process of developing accurate and reliable nursing diagnoses.

\(^1\) Those accepted by the North American Nursing Diagnosis Association (NANDA).
Patient care plans are one of the most important documents in a clinical setting, since they outline the specific nursing measures that are to be used in caring for the patient. These plans are based on the health problems encountered during the assessment phase of the nursing process. The nurse’s goal is to produce high quality patient care plans, which contents will help patients meet their health needs in a time and cost effective manner.

Nurses must rely on their knowledge and experience when it comes to designing a patient care plan [Witter83]. Performing this task may not be as simple as one would think, since each plan must be developed based on a specific, previously formulated diagnosis. In order to deal with this situation, some hospitals have turned to the use of care planning formats [Arnold92]. These documents can be created and stored either on paper or as an electronic document on a computer. The idea is to let the nurse design a care plan using a predetermined, limited universe of expected client outcomes and interventions from which to choose.

Although these formats look to ease the process of developing a plan of care, there are several limitations to this approach. First, every plan of care generated starts with a common document, which varies according to the diagnosis formulated. From this document the nurse chooses that information which most closely matches the patient’s condition. However, information not related to the patient, and therefore not chosen by the nurse, has no way of being eliminated from the document. This puts more stress on those who will eventually be reading this personalized version of the document, since they would have to go through all the document just to look at what has been chosen for a specific patient. The computerized version of the document suffers the same problem, since it does not provide any means for dynamically dropping
redundant information. All redundancies must be deleted manually, since the word-processor style of the underlying application does not provide for the automatic detection of unnecessary fields in the personalized document.

Second, the format in which these documents are stored makes it very difficult to obtain statistical data which can support the process of auditing the nursing department. For example, the number of patients which were diagnosed with a given condition, the different measures applied to them, and the number of favorable results are all statistical information which could be generated using the care plans from different patients.

Finally, paper-based care plans (like any other paper document) are difficult to manipulate, because of the required storage space and the amount of time needed to access their information once they have been filed. Thus, the study of new methodologies for the development of nursing diagnoses must be accompanied by the analysis and development of new ways to accurately and dynamically generate a patient’s plan of care.

The investigation, and possible development, of a computer-based system capable of assisting the nurse in the process of formulating nursing diagnoses, and the incorporation of these into the patient’s care plan, can bring many benefits to both the nurse and the patient. These include:

- Availability of information.

Information can be readily available to all authorized personnel. The fact that all data redundancies can be eliminated from the patient’s plan of care makes it an accurate, high quality guide for delivering excellent patient care services.
• Higher efficiency in health care administration and management.

Evaluation of methods and results for any given diagnosis can be automated, thus making the auditing process one much faster, simpler, and consequently more efficient.

• Clinical benefits.

The ability of the system to identify those patterns which could otherwise be overlooked by the nurse will guarantee the highest quality in patient care plans. The proper implementation of these plans will result in a higher level of patient satisfaction.

• Cost Savings.

• Better quality of care.
Previous Work

The field of Nursing Informatics emerged from the needs of health care institutions to provide high quality services within reasonable time limits. Thanks to the introduction of computer technology in the clinical setting, notable results have been attained regarding prompt patient care [Hannah94].

Research efforts in the field have been focused mainly on the automation of simple documentation tasks, such as the retrieval and modification of information in patient records. Most of the solutions offered are the product of organizations that have a limited understanding of human factors, usability, and human-computer interaction [Gosbee97]. For example, the CPR software for hospitals, developed by PMR Inc. [PMR97], is a system for creating and maintaining patient care records. It can run on any number of machines interconnected by a network. It provides full support for the process of nursing documentation, but limited only to the S.O.A.P. 2 format. The fact that CPR is a textual based system makes it somewhat inefficient, from a usability standpoint. Large quantities of data are simultaneously present on the screen, which can at times become redundant for the task at hand.

ChartWizard, by Wizard Medical Systems Inc. [WMS97], is a computerized patient charting system for the Windows and Macintosh platforms. It provides a completely graphical user interface, which facilitates user interaction. It contains over 20 modules, each responsible for

---

2S.O.A.P. stands for Subjective analysis, Objective analysis, Assessment, and Planning. This is the most common format used on the clinical setting for documenting patient care.
a different task. Several modules are directly related to the nursing function of documenting patient care. However there is no dynamic support for the processes of diagnosis and care plan generation.

As previously mentioned, research efforts in these areas of nursing diagnoses and patient care plans have been minimal. The CANDI system for nursing diagnosis [Chang88], and the COMMESS system for nursing plans [Evans88] are notable exceptions. However, these systems do not take into account the principles of user-centered design and usability that are key to the successful usage of such systems.

Many health care institutions have implemented proprietary systems for supporting the different tasks they must carry [Anderson97]. However, the majority of these systems are targeted to administrative and financial duties, and very little support has been given to the nursing function.
Objectives

The main objective of this research involves the study, development, and subsequent analysis of a graphical-user-interface agent capable of transparently supporting interaction between a user (nurse) and the underlying decision support logic.

The decision support component will contain the necessary data, along with all the logic needed to generate accurate and reliable information for both nursing diagnoses and patient care plans. Nevertheless, our research efforts will focus primarily on the graphical-user-interface component, since it is this area where the fewest research efforts have been recorded.

There are several factors that affect the efficiency with which nurses perform the tasks of diagnosis and care plans. The most important of these is the way in which nurses are presented with the information, whether on paper or on a computer screen. We believe, and this study intends to show, that the way in which information is accessed and presented to the user has a considerable impact on the efficiency with which these documents are formulated, as well as on the accuracy of their contents. Also, the methodology used for the human-interface interaction will have an effect on the level of performance attained with the system.

In order to properly (and effectively) assist the nurse in this documentation process, we must analyze the existing documentation methodologies (or notations) and integrate the most appropriate one(s) into the design of the user interface. This will guarantee the most accurate mapping between computer and user concepts as the system is being used.
According to John Gosbee, “Many medical software organizations have a limited understanding of human factors, usability, and human-computer interaction (HCI)” [Gosbee97]. In order to acknowledge the importance of these elements in the design process of any user interface, our entire study will be guided by HCI as well as Usability Engineering principles [Nielsen93]. The systematic application of these principles into the design process will lead us to a product that is easy to learn and use. The interface must be simple such that nurses do not become frustrated with its use. Rather, they must be as productive as (or even more than) they would be under non computer-supported (original) work conditions.

Another focal point of this study will be the application of a user-centered design methodology to the development process. This means integrating the user (the nurse) to the design process, in order to create a product that truly meets the user’s needs. This is very important, since the majority of commercially available systems do not take into account the specific needs of end users, nor their work atmosphere [Tuttle97]. Therefore, user involvement will be a key factor to the success of the study.

The results of this effort will hopefully serve as a theoretical, as well as practical, frame of reference for the development of new interface design principles. In this manner, we expect to make a valuable contribution to the fields of Medical and Nursing Informatics, as well as to the general health care setting.
Procedure

The activities to be conducted are based on the *usability life cycle* [Nielsen93], which is essentially a series of steps that lead to the development of more efficient user interfaces. We’ll follow this approach (to a certain extent) since our main objective is the development of a usable interface, from a nurse’s point of view.

The activities to be conducted are therefore:

- **Analysis of the field of practice.**
  
  One of the most important activities in any software development effort involves the analysis of the user’s work environment along with the specific tasks that must be performed on the setting. This is done in order to understand the user’s needs, as well as their expectations regarding a new system. Our analysis will be based on task data collection techniques, such as unstructured interviews and verbal protocols, along with some task description techniques, such as hierarchical task analysis (HTA) [Kirwan92].

- **Development of proper methodologies.**

  This activity involves the development of new, or the extension of already existing methodologies for the documentation of diagnoses and care plans. There are currently several different methodologies (or notations) which can be used in the documentation process. Some of these are *POMR*, *SOAP*, and *narrative notes* [Witter83]. Our goal is to analyze each of these methodologies and, based on their suitability and user
acceptance, expand the most appropriate one(s) so that it/they can be effectively embedded in the graphical user interface development effort.

• **Prototype development.**

Once we understand the nurse’s mental model of their documentation activities and define suitable methodologies for use, we can initiate the development of a prototype that can be used to conduct tests with real users (nurses) and give them an idea of what they can expect from the system.

• **User testing of prototype(s).**

It is on this stage where the concept of *user-centered* design becomes evident. The prototype will be submitted to testing with real users so that major as well as potential usability problems can be identified. Short interviews will be conducted with each user in order to gather his/her opinion and any feedback that can be used during the refinement process.

• **Prototype refinement.**

After testing is conducted and feedback is gathered, the system is modified so as to account for all the major (and minor) usability problems encountered. We can then submit the refined prototype to another round of user testing. Therefore, the user testing and refinement cycle will be executed until the majority of usability errors have been detected and corrected.
- **Final prototype testing.**

  Once we reach a final\(^3\) version of the prototype, we can perform several tests on it, again with real users. These tests will help us gather information that will be used during the results analysis phase.

- **Analysis of results.**

  Final results will be used to either confirm or refute the objectives and goals of this research. After a complete analysis of the results is performed, suggestions will be made regarding those areas in which research can be carried out, and how this work can benefit from those new efforts.

  This Research will be conducted at the *Human-Computer Interaction Laboratory* facilities. These are located on the Electrical and Computer Engineering Building of the University of Puerto Rico, Mayagüez Campus. Collaboration from local health care institutions will also be sought, for activities such as task analysis and user testing.

---

\(^3\) A difficult task, since new usability problems can be introduced each time the prototype is refined.
Bibliography


<table>
<thead>
<tr>
<th>Reference</th>
<th>Details</th>
</tr>
</thead>
</table>