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Evaluating an ICNP Web-based Nursing Documentation System

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Abstract

The purpose of this paper is to present the evaluation of a web based nursing documentation system which helps nursing professionals and students to study ICNP Greek beta 2 version and to create nursing diagnoses, interventions and outcomes by selecting relevant terms from ICNP. This advanced web-based ICNP browser enables the authentication of the user, and the creation of a type of nursing care plan through the use of ICNP. It provides different ways for creating nursing diagnoses, interventions and outcomes, by selecting relevant ICNP terms through the tree-structure view, index and search components of the tool. The evaluation of this nursing documentation system is carried out by a survey among nursing professionals working in nursing units in hospitals. The results which have derived from this survey are presented. Moreover, conclusions regarding the future changes that should be made in the system are reported.

Keywords

Nursing Informatics, Terminology, Internet, User-computer interface, Data Display.

Introduction

Controlled nursing vocabularies are necessary to support nursing information by describing nursing process and by documenting nursing care. Thus, they are an integral part of computer-based health records and an important factor when developing health information systems [1], [2], [3]. Nowadays, a significant number of nursing vocabularies has been created. In the US the American Nursing Association (ANA) has developed specific criteria and a process for official recognition of the existing classification systems [2]. In the International level, the International Council of Nurses (ICN) initiated in 1989 a long term project to develop an International Classification for Nursing Practice (ICNP). It is an international effort to develop a nursing terminology and classification that can be used worldwide to describe and organize nursing data for nursing care [4]. ANA recognised ICNP in 2000 [5]. The ICNP is defined as the classification of nursing phenomena, nursing actions, and nursing outcomes. As an informational tool to describe nursing practice, it can be used to make nursing practice visible in multidisciplinary health information systems. The alpha version was released in 1996, the beta in 1999, while in 2001 some changes have been released in the ICNP beta 2. The latest changes reflect mainly editorial correction of the beta version. ICNP Version 1 is planned to be released in 2005 [6]. As part of the achievements of Telenurse and TelenurseID-ENTITY (Integration and Dissemination of European Nursing Terminology in Information TechnologY) EC projects, ICNP was translated from English into several European languages. The translation of both alpha and beta ICNP versions in Greek language was organised by Health Informatics Laboratory of the Faculty of Nursing of the University of Athens, which has participated in both European projects [7], [8]. ICNP beta has been designed as a multi axial and poly hierarchical classification, with one top term being subdivided according to several different principles of division. Such structure allows different concepts in nursing clinical practice to be expressed as combinations of concepts from different axes or hierarchies. The three main classifications are nursing phenomena, nursing actions and nursing outcomes [9].

ICNP is proposed by this work to be implemented in a computer-based system, especially in a web-based care planning system. ICNP possess specific characteristics needed for implementation in such systems. Compared to other language systems developed to represent nursing judgements in computer- based systems, ICNP meets most of the criteria required [1], [10], [11].

In this study we developed an ICNP web based nursing documentation system and evaluated it for its usability, and examined how nurses responded to this proposed system.

Materials and Methods

System design and implementation

We used the Greek translation of ICNP beta 2 version in order to design and implement a web based nursing care-planning system. This system includes the steps of creating and storing nursing diagnoses, nursing interventions taken in response of the nursing diagnoses and nursing outcomes as a measure of the selected nursing diagnoses. ICNP is used as the classification system of nursing practice terms for the selection of the appropriate terms and the composition of the relevant steps for the completion of a specific nursing care plan. Each nursing diagnosis, intervention and outcome that is created by using terms from the axes of ICNP, in order to compose specific care plans, is stored in a database. This database is used for the facilitation of the completion of other nursing care plans.

If nursing diagnoses, interventions, outcomes or completed care plans are to be accessed, and they are already stored to the database, they are presented on the screen, according to the user's requests to the database, through the web interface of the application (Figure 1).

On the other hand, if a new nursing diagnosis, intervention or outcome is about to be created an ICNP browser with enhanced features is provided as an encapsulated tool of the system. This ICNP browser enables the selection of ICNP terms in three different views. The tree-structure view presents terms from the selected ICNP axis according to its hierarchical structure. The index view of the implemented ICNP browser, indexes ICNP terms in alphabetical order. The third view (search view) provided, presents the results for the given searching keyword(s), while in the application's status bar the number of found terms appears. The keyword(s) given for the searching process can be sought either in the field of ICNP terms, or in that of ICNP description or even in both fields. Moreover, the ability of conducting compound searches by using more than one keywords being composed with the logical operators AND, OR, NOT is provided. Adding free text to the created nursing diagnosis is also available by the application. Figure 2 presents the creation of a new nursing diagnosis by selecting ICNP terms through search view with the small movable window opened for free text input. This window can store temporarily the free text added to accompany the selected nursing diagnosis (or intervention, or outcome) [12].

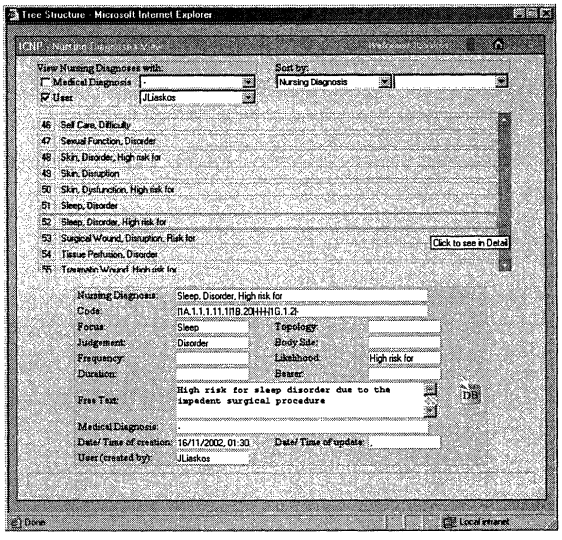

Figure 1 - Viewing the stored nursing diagnoses

In the status bar other messages are also appeared each time. For example, if the nursing diagnosis combined by the selected terms is to be stored in the database but it is not consistent with the rules of composing a diagnosis, an error message appears avoiding the storing of an invalid diagnosis [12].

Our nursing care planning system was proposed to be implemented in the client – server model and to run as an intranet or internet application, while the security requirements were taken into account. The main benefit of such an implementation is that the user has the ability to access parts of the system authorised to do so, and select, insert or update data, through a web browser from every computer that is online provided that it fulfils the security requirements (user authentication, IP confirmation).

For the implementation of the data storing and management of our system, Microsoft SQL Server 2000 RDBMS was selected. An MS SQL Server database can be replicated via the Internet and make data accessible to users in remote locations throughout the world. Furthermore, MS SQL Server security features protect data from users that should not be viewing or adding, changing, or deleting the data.

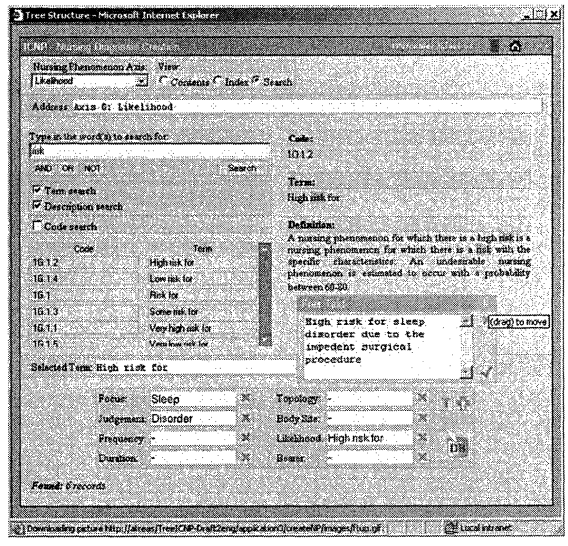

Figure 2 - Creating a new nursing diagnosis by selecting ICNP terms through search view

The design of the web site was based on Microsoft's server side technology, ASP version 3.0. This version was released along with Internet Information Server (IIS) version 5.0 as part of the MS Windows 2000 OS. The idea of an ASP is that the page is generated by the server at the time of the request, and can be changed according to the parameters the client sends to the server. Another way apart from ASP-ADO technology, which provides more direct results and was also used in specific parts of the implementation of our nursing care planning system, is SQL-XML [13], [14], [15].

The scripting language used for the development of the web interface of the database, is VBScript for the server-side, and Jscript for the client-side scripting. DHTML (Dynamic HTML) innovating features of MS Internet Explorer are also exploited, whereas the declarative language of Cascading Style Sheets (CSS) is utilized [16].

Evaluation procedure

In order to evaluate the ICNP based nursing documentation system we studied a sample of 32 persons. This sample consisted of nurses and postgraduate students of the University of Athens (studying in the master's course programs of 'Clinical Nursing' and 'Health Informatics'). Most of the subjects, had graduated the Faculty of Nursing of University of Athens, and possessed a working experience in hospitals in Athens region. Since most of them had graduated nursing, they had at least already attended the courses of : Introduction to Informatics, Health Informatics,

Table 1: Descriptive statistics of user interaction satisfaction and after scenario usability questionnaire

QUIS – Questionnaire for User Interface Satisfaction (Rate system's satisfaction)			
Category	**Question**	**Mean**	**S.D**
Overall reaction to the software	*terrible/wonderful*	6.09	1.35
	difficult/easy	5.81	1.96
	frustrating/satisfying	6.41	1.56
	Inadequate power/ adequate power	7.03	1.38
	dull/stimulating	5.88	2.32
	rigid/flexible	6.43	1.48
Screen	Organization of Information: *confusing/very clear*	6.50	1.68
	Sequence of screens: *Confusing/very clear*	6.75	1.67
Terminology & system information	Use of terms throughout system: *inconsistent/consistent*	6.69	1.28
	Computer terminology related to the task you are doing: *never/always*	6.34	1.43
	Position of messages on screen: *Inconsistent/consistent*	6.77	1.49
	Computer keeps you informed about what it is doing: *never/always*	6.71	1.70
	Error messages: *Unhelpful/helpful*	6.04	2.06
Learning	Learning to operate the system: *difficult/easy*	5.23	2.33
	Exploring new features by trial and error: *difficult/easy*	5.62	2.13
	Remembering names and use of commands: *difficult/easy*	4.97	2.30
	Tasks can be performed in a straight-forward manner: *never/always*	6.09	1.99
	Help messages on the screen: *Unhelpful/helpful*	6.21	1.92
System Capabilities	System Speed: *too slow/ fast enough*	6.28	1.69
	System reliability: *unreliable/reliable*	6.66	1.76
	Correcting your mistakes: *difficult/easy*	6.28	2.12
	Designed for all levels of users: *Never/always*	5.06	2.29

After-Scenario Questionnaire (Rate Usability of system for the specific scenario)			
Category	**Question**	**Mean**	**S.D**
After Scenario Usability	Overall, I am satisfied with the ease of completing the tasks in this scenario: *Disagree/Agree*	4.65	1.43
	Overall, I am satisfied with the amount of time it took to complete the tasks in this scenario: *Disagree/Agree*	5.65	1.23
	Overall, I am satisfied with the support information (online help, messages documentation) when completing the tasks: *Disagree/Agree*	4.50	1.48

and "Hospital Information Systems" in their undergraduate studies. At the beginning, an introduction to ICNP terminological system and to nursing information systems was given to the volunteer nurses. After that, the developed system was demonstrated and its basic functions were explained. The users had ten minutes to be familiar with the functions of the documentation system. Following that, they were asked to use the system by completing a number of care plans for one specific patient scenario. They selected a virtual patient with a specific medical diagnosis, and they created at least one nursing diagnosis by using terms of ICNP, nursing goals (potential outcomes), nursing interventions and nursing outcomes for the specific nursing diagnosis. When the users completed this task, they were distributed a questionnaire for measuring the user satisfaction and usability of the application.

User interaction satisfaction was measured by using a modified version of the Questionnaire for User Interface Satisfaction (QUIS) [17]. This modified version of questionnaire included 22 of the 27 initial questions. The 5 questions omitted were not very relevant to our application. Together with the QUIS, the after-scenario questionnaire [18] was used for the assessment of the usability of the system for the scenario preceded. The QUIS was designed to evaluate the user's subjective satisfaction with a system's interface and their perception of its usefulness. Each question has a scale from 0 to 9. The after scenario questionnaire, was asking the users to rate, in a 7-point scale, their level of agreement or disagreement with 3 questions provided. Demographic data were also collected, while qualitative data were obtained by including "open questions" in the questionnaire, and through discussions and semi-structured interviews with the nursing professionals, after the completion of the questionnaire. Through these questions we aimed to assess the users' general impression of the nursing documentation system, their opinion about the system's advantages and drawbacks, and its perspective future usage; moreover their opinion about the ICNP.

Results

The analysis of the data was performed by using the Statistical Package for Social Sciences for Windows (SPSS, v.10.0) [19]. The majority of the nurses were females, where in the sample of 32 volunteer nurses only 7 (21.87%) were male and 25 (78.13%) female persons. The average age of the subjects participating in the survey, was 26 years old (S.D. 3.6).

The majority of participants had graduated the Faculty of Nursing of the University of Athens and already possessed a high level of computer knowledge and skills. During their studies in university they had attended 2 or 3 courses relevant to computers and informatics. Their knowledge regarding common computer applications (word processing, spreadsheets, email, Internet, databases) and hospital/ nursing information systems, or computerised health records was characterised satisfactory.

The results of the mean and standard deviation values for each question of the Questionnaire for User Interaction Satisfaction and the After Scenario Questionnaire are presented in Table 1.

The overall mean value of the modified QUIS was 6.18. The question with the highest score was in the "Overall reaction to the software" category: "*Inadequate power/adequate power*", with mean value 7.03, followed by "Position of messages on screen: *Inconsistent/consistent*" of the "Terminology & system information" category (mean: 6.77), and "Sequence of screens: *Confusing/very clear*" of the "Screen" category (mean: 6.75). The lowest score was found out in the "Remembering names and use of commands: *difficult/easy*" of the "Learning" category (mean: 4.97), followed by "Designed for all levels of users: *Never/always*" of the "System Capabilities" category (mean: 5.06), and "Learning to operate the system: *difficult/easy*" of the "Learning" category (mean 5.23). The overall mean value of the after scenario questionnaire was 4.93.

The interviews with the nursing professionals took place after they had completed the questionnaire. Some of the questions the users – testers of our documentation system were asked are the following: What are your impressions from the testing of the nursing documentation system? What do you think are the advantages and disadvantages of the nursing documentation system you tested? Do you believe that the specific nursing documentation system helps users to understand and learn the ICNP classification system? Do you believe that the specific nursing documentation system can be used for the education and training of nurses on the ICNP and/ or the nursing care planning/ nursing documentation/ nursing process? Do you believe that the specific nursing documentation system can be applied in a nursing ward so as to be used by nurses in "real conditions" for their patients' care planning? What is your opinion about the ICNP classification system?

The nurses in their majority expressed a positive attitude towards the tool developed. They considered it innovative and interesting, useful and simple to its use (*"on first sight it seems too complicated and difficult to use it, however the more someone gets used to it, the more usable and functional it becomes"*), and the majority agreed that it demands more time for training (*"I need more time to understand all its features and be familiar with its use"*). However, a few nurses considered it too theoretical. Some of the positive points of the tool expressed are the web access (from any computer connected on intranet/ internet through a web browser), the easy to use and effective search features, which decrease the time needed for creating an ICNP based care plan, the flexibility and comprehensiveness. The help support was said to be one of the tool's weak points. Some users proposed us to create and include a kind of tutorial or wizard, which will train and guide them while using the tool. Most of the users agreed that the tool could be used, under certain conditions, as an educational tool even for teaching ICNP or nursing care planning; moreover they feel that they learned a lot about ICNP through their interaction with the tool. As far as the users' reaction in the usage of the specific nursing documentation system in "real conditions" is concerned, the views are diverse (*"Difficult to be used in Greek hospitals due to the luck of nurses and the computer illiteracy of the majority of nurses"*). Regarding the uses' opinion about ICNP classification system, most of them had very little experience on ICNP. Some quotes from the users about it are: *"It seems very interesting but there is a great danger of an excessive formalization of nursing"*, *"Too complicated for its use in the everyday nursing practice, due to the luck of time, and the luck of well educated nurses"*, *"Many steps have to be taken before its acceptance by clinical nurses and use in the everyday practice"*.

Conclusion and Future Developments

We presented the evaluation procedure of a developed system that allows the documentation of nursing practice with the use of an internationally accepted nursing vocabulary. This system integrates ICNP and runs in a web environment. For the evaluation of this documentation system we used both quantitative and qualitative methods, assessing mainly the user interface satisfaction and the application's usability. The quantitative methods applied, include the Questionnaire for User Interface Satisfaction [17] and an IBM's after scenario questionnaire [18]. Demographic data were also collected. The qualitative methods

include open questions and discussions/ semi-structured interviews with the users.

The sample we studied had a satisfying level of experience in computers. However, we believe that a larger variance of ages would be preferable to exist. The user interface satisfaction had an average mean score, which was above the midpoint of the evaluation instrument (4.5); moreover the assessment of the system's usability based on specific scenario (creating ICNP care plans for a given virtual patient) provided a high average mean (4,93 while the midpoint is 3.5). One of the weak points of our system that needs improvement is the provision of "help" support to the user. Our next step is to develop a detailed multimedia tutorial, which will train the user in the proper use of each function of our documentation system. The specific tool seems to be suitable for educational purposes. Our intention however, is to test the specific documentation system in a nursing ward, even though there are a lot of different obstacles that have to be surpassed before.

The results we presented seem to be encouraging for the implementation of the web based ICNP documentation system in nursing wards. In our next plans, we aim to integrate standardised (predefined) nursing care plans based on ICNP, which will support the understanding and implementation of the nursing care process and it will be of extreme help to nursing education and then to implement the system in a pilot nursing care unit. We aim to evaluate our system in a 'real' clinical environment and we to examine if it is possible for the clinical nurse to adopt ICNP terminology in such a system, given the little progress that has been made in Greek hospitals in the use of a common acceptable method for documenting nursing practice.

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