Visualized Multi-Dimension Access to Database

다차원 시각화 방법을 이용한 데이터베이스 접근방법

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Traditionally, nurses keep the written patient records, which are referred as nursing care plan. Nursing care plan reports are one of the most important documents in the application of nursing processes. Typically, nurses prepare the plans by including general patient information as well as the patient's medical history information. In addition, the patient's developmental history and other specific health related information are part of the plans. The plans are usually concluded with the goals of the nursing care plan, nursing diagnoses, expected outcomes of the care, and possible nursing interventions. The nursing diagnoses, outcomes, and interventions are defined by North American Nursing Diagnosis Association (NANDA). This means that the nurses will select the appropriate diagnoses, outcomes, and interventions from an approved set. We developed a web-based nursing care plan generation system. In this paper, we report our work on developing a visual interface to the NANDA nursing diagnoses, outcomes, and interventions database as a part of the web-based nursing care plan generation system.

1. Introduction

The nursing care plans include the systematic explanation of the facts gathered during the patient assessment stage and also the analysis of the facts. In addition, the plan describes the nursing diagnosis based on the facts and the analyses. The nurses develop a plan of care that prescribes interventions to attain outcomes then include them in the planning documentation. The care plan is prepared to provide continuity of care from nurse to nurse, to enhance communication, to document the nursing process, to serve as a teaching tool, and to coordinate provisions of care among disciplines (Doenges & Moorehead, 2003).

Typical nursing care plan includes the background information about the patients such as the general biographical information, the medical history, various health related information, physical and mental state assessment results, nursing diagnoses, suggested interventions, and expected outcomes. Often certain information such as the medication records is also included. However, much of the information is conveyed as narratives of the nurses and the direct quotes from the patients. The nurses compile patients' conditions in the form of the facts that the nurses observed.

monologue by the patient, patient's answers to the nurse' questions, and the patient's condition conveyed by others such as family members. Then, the nurses often summarize the factual information.

Consequently, the nurses form their evaluation of the patient's condition based on the summarized factual information. A nursing diagnosis is the result of the evaluation. It is defined as a critical judgment about individual, family, or community responses to actual or potential health problems or life processes. The goal of a nursing diagnosis is to identify health problems of the patient and his/her family. A diagnosis provides a direction for the forthcoming nursing care (Sparks and Taylor, 2000). In addition to the actual skills of caring for the patients, the nursing education put heavy emphasis on developing nursing diagnosis capabilities.

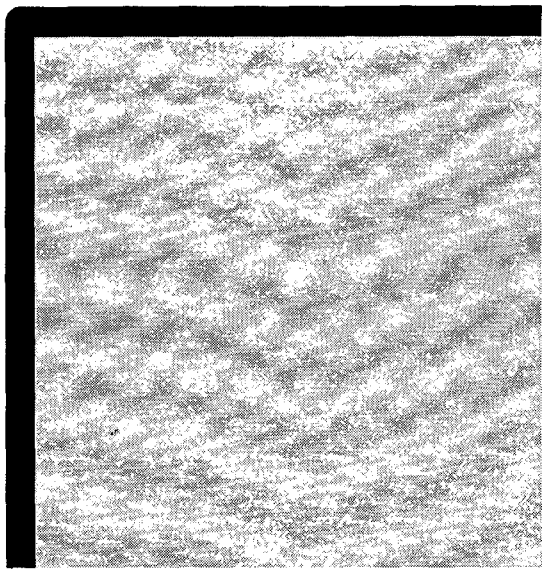
We developed a web-based nursing care plan generation system to help the nurses during the data collection as well as the nursing diagnosis stages. Especially, we developed a visual interface to the NANDA approved nursing diagnoses, outcomes, and interventions database. In this paper, we report the development and comparative evaluation results based on a table-based and a hyperbolic tree-based interface. The interface is designed to be used by the nurses to select the most appropriate diagnoses, outcomes, and interventions given the patient conditions.

2. Web-based Nursing Care Plan Generation System Overview

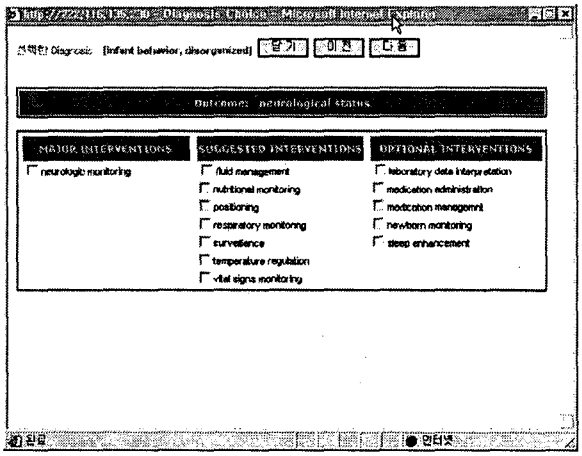
We designed the web-based nursing care plan generation system to maximize the accessibility by the nurses. The system consists of two sub-components. The first component is referred as the Patient Information Survey System. This system is used to collect the subjective data about the patients. The system is implemented
as a web-based survey, which is accessible via an Internet accessible personal computer. The web survey pages displayed on a personal computer are directly fetched from a remote web server. The data entered on the web-based survey is directely fed into a remote database server. The web-based survey was designed and implemented mainly as a point-and-click interface with the minimum typing requirements. The main goal of this design decision was to reduce any difficulties that the nurses might encounter when using a computerized survey form especially when they are not used to computers.

The second component of the web-based nursing care plan generation system is the Nursing Diagnosis, Outcome, and Intervention Selection System. This system is used by the nurses to synthesize every piece of patient information that has been collected and analyzed. There is no information collection function in this system. The nurses will initially

determine one or more nursing goals to achieve given the patient's conditions. After the goal determination, the nurses will select one or more nursing diagnoses. There are 167 NANDA approved nursing diagnoses (Sparks and Moorehad, 2000). The nurses examine the defining characteristics of each diagnosis against the patient information then select the most appropriate diagnoses. There is a mapping table from each diagnosis to a set of potential nursing outcomes. There are 330 nursing outcomes (Moorehead, et al, 2003). Not all outcomes in the matching set will be applicable to the patient in consideration. Thus, the nurses need to go through each outcome in the matching set then select the best possible outcomes based on the pre-selected goals, diagnoses, and the patient conditions. Finally, there are 514 nursing interventions (Dochterman and Bulechek, 2004). Each nursing outcome is also linked to a set of interventions although, not all interventions in the matching set will be applicable to the patient in care. Therefore, the nurses will be required to review each intervention in the matching set to select the most potentially effective interventions to be applied.



<Table 1> Nursing Diagnosis, Outcomes, and Intervention Database Schema

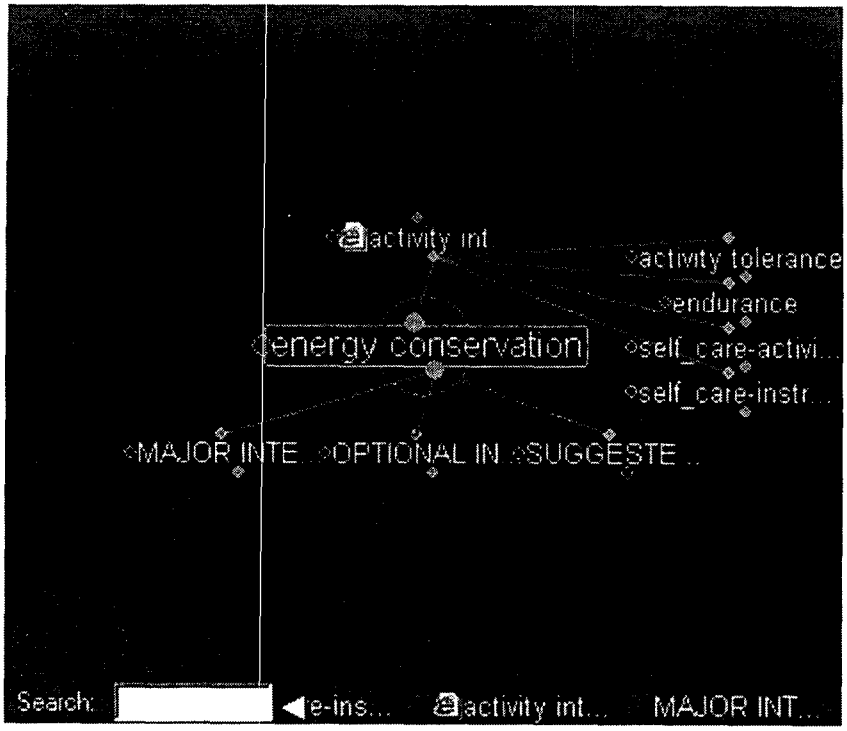


<Figure 1> Table based nursing diagnosis, outcome, and intervention selection system

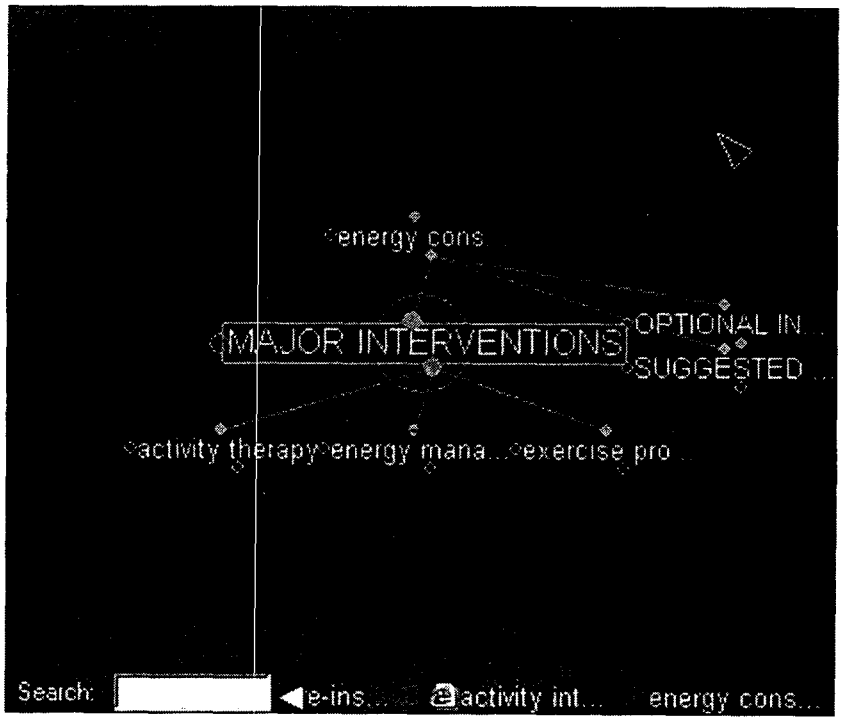
3. Nursing Diagnosis, Outcome, and Intervention Selection System

We developed two versions of the nursing diagnosis, outcome, and intervention selection system. The first version is a table based system. Its interface is developed using PHP, HTML, and Javascript. The interface is connected to a mySQL database, which contain the diagnoses, outcomes, and interventions related data. The database schema is shown in the Table 1.

After the database is connected. 'like'



<Figure 2> Hyperbolic View of the Nursing Diagnosis and Outcomes



<Figure 3> Hyperbolic View of the Nursing Outcome and Interventions

query is used to get the selected data. It takes long time to load all selected data. Thus, we utilized a paging technique to load only 20 items per each load. This makes the system more responsive to the user actions on the interface. The user selected data is stored in a separate database table so that the users can recall what he/she has done without sending a new query to the database. The Figure 1 shows the table based system after the user selected 'infant behavior, disorganized' as the nursing diagnosis and neurological status as the corresponding expected outcome for this diagnosis. The user is given a number of possible interventions that he/she can choose from.

This other version of the nursing diagnosis, outcome, and intervention selection system is based on a hyperbolic view based system. For this research, we used PersonalBrain, a commercial off the shelf software from The Brain Technologies Corp (http://www.thebrain.com/). PersonalBrain is an information visualization system, which enables the users to link information into a network of logical associations. PersonalBrain uses 'Thoughts' to refer 'concepts' and 'Links' to refer 'relations'. Figure 2 shows the screen shot when the user selected 'energy conservation' as the expected outcome of the 'activity intolerance' diagnosis. The selected outcome is shown in the middle of the screen and the pre-selected diagnosis is shown at the top of the screen. Figure 3 shows three possible major interventions for 'energy conservation' at the bottom of the screen. 'Energy conservation' was the pre-selected outcome.

4. Evaluation and Conclusion

We conducted a preliminary evaluation of both interfaces by having several nursing science students to use the system. The students took 'Psychiatric Nursing' course, which was offered in the Spring and Fall 2005 semesters at the Dept. of Nursing Science, Konkuk University in Korea.

We conducted a preliminary qualitative interviews after the students have tried out the systems. Many students noted that the hyperbolic visualization based interface is interesting at the first glance. However, it became confusing very soon. This observation is similar to what people had regarding hyperlink based systems. We plan to conduct a formal evaluation and report the results in a future forum.

5. References

Dochterman, J.M. and Bulechek, G.M. 2004. Nursing Interventions Classification (NIC) 4th Edition. St. Louis: Mosby.

Doenges, M. and Moorehead, M.F. 2003. *Application of Nursing Process and Nursing Diagnosis: An Interactive Text for Diagnostic Reasoning* 4th Edition, F.A. Philadelphia: Davis Co.

Moorhead, S., Johnson, M., and Maas, M. 2003. *Nursing Outcomes Classification (NOC)* 3rd Edition. St. Louis: Mosby.

Sparks. S.M. and Taylor, C.M. 2000. *Nursing Diagnosis Reference Manual* 5th Edition. Pennsylvania: Springhouse.