Ribeiro dos Santos, Sérgio

Informática em enfermagem: desenvolvimento de software livre com aplicação assistencial e gerencial

Available in: http://www.redalyc.org/articulo.oa?id=361033304008

Computers in nursing: development of free software application with care and management

INFORMÁTICA EM ENFERMAGEM: DESENVOLVIMENTO DE SOFTWARE LIVRE COM APLICAÇÃO ASSISTENCIAL E GERENCIAL

COMPUTADORAS EN ENFERMERÍA: DESARROLLO DE SOFTWARE LIBRE CON APLICACIÓN ASISTENCIAL Y GERENCIAL

Sérgio Ribeiro dos Santos[1]

ABSTRACT

This study aimed at developing an information system in nursing with the implementation of nursing care and management of the service. The SisEnf - Information System in Nursing - is a free software module that comprises the care of nursing: history, clinical examination and care plan; the management module consists of: service shifts, personnel management, hospital indicators and other elements. The system was implemented at the Medical Clinic of the Lauro Wanderley University Hospital, at Universidade Federal da Paraiba. In view of the need to bring user and developer closer, in addition to the constant change of functional requirements during the interactive process, the method of unified process was used. The SisEnf was developed on a WEB platform and using free software. Hence, the work developed aimed at assisting in the working process of nursing, which will now have the opportunity to incorporate information technology in their work routine.

KEY WORDS
Information systems.
Nursing informatics.
Nursing care.

RESUMO

O presente estudo teve como objetivo desenvolver um sistema de informação em enfermagem com aplicação na assistência de enfermagem e no gerenciamento do serviço. O SisEnf – Sistema de Informação em Enfermagem - é um software livre composto pelo módulo assistencial de enfermagem: histórico, exame clínico e plano de cuidados; o módulo gerencial compõe-se de: escala de serviço, gestão de pessoal, indicadores hospitalares e outros elementos. O sistema foi implementado na Clínica Médica do Hospital Universitário Lauro Wanderley, da Universidade Federal da Paraíba. Tendo em vista a necessidade de aproximação entre usuário e desenvolvedor, e a constante mudança de requisitos funcionais durante o processo iterativo, foi adotado o método do processo unificado. O SisEnf foi desenvolvido sobre plataforma WEB e com emprego de software livre. Portanto, o trabalho desenvolvido procurou auxiliar o processo de trabalho da enfermagem que agora terá oportunidade de incorporar a tecnologia da informação na sua rotina de trabalho.

DESCRITORES
Sistemas de informação.
Informática em enfermagem.
Cuidados de enfermagem.

RESUMEN

El presente estudio tuvo como objetivo desarrollar un sistema de información de enfermería con aplicación en la atención y en el gerenciamiento del servicio. El SisEnf -Sistema de Información en Enfermería- es un software libre compuesto por: a) el módulo asistencial de enfermería: historias clínicas, exámenes clínicos y plan de atención; y b) el módulo de gerenciamiento, que se compone de: escala de servicio, gestión de personal, indicadores hospitalarios y otros elementos. El sistema se puso en práctica en Clínica Médica en el Hospital Universitario Lauro Wanderley de la Universidad Federal de Paraíba. En vista de la necesidad de aproximación entre usuarios y desarrolladores y del cambio constante de las necesidades funcionales durante el proceso iterativo, fue adoptado el método de proceso unificado. El SisEnf fue desarrollado sobre una plataforma WEB con empleo de software libre. En conclusión, el trabajo desarrollado procura brindar auxilio en el proceso de trabajo de enfermería, que ahora tendrá la oportunidad de incorporar a la tecnología de la información en su rutina de trabajo.

DESCRIPTORES
Sistemas de información.
Informática aplicada a la enfermería.
Atención de enfermería.

[1] RN. PhD in Sociology and Health Sciences. Associate professor at the Federal University of Paraíba, Departament of Clinical Nursing. João Pessoa, PB, Brazil. srsantos207@gmail.com

INTRODUCTION

In recent years, an intensive effort has been applied to the development of nursing information systems to systematically and efficiently meet the needs of nursing recording in the Medical Clinic at the Lauro Wanderley University Hospital (UHLW), Federal University of Paraíba, Brazil. Software to be used in nursing care and management has been finally completed. The system was developed to be used in the development of a nursing care plan. For that, all the methodological steps for the construction of a nursing therapeutic process, from anamnesis to the care plan with respective diagnoses, nursing interventions and the patients' clinical development were observed.

The development of nursing informatics in the medical clinic at the UHLW has been a great challenge to researchers and the health team. There are several operational difficulties, which are mainly of a managerial and political nature. Nurses spend much time in activities not directly related to care, devoid of nursing actions. These bureaucratic activities include filling in forms, whose implementation is characterized by routines that distance nurses from patients due to the need to complete these tasks[1].

On the other hand, the quantity of information concerning patients increases in treatment protocols. Thus, the manual system of taking notes on the patients' medical charts is inefficient to ensure the recording and storing of information. Moreover, notes are inconsistent, illegible, and difficult to understand, with no systematization of information[2]. These factors have led many researchers to develop studies in the field of Information Technology to contribute to the advancement of this discipline, still incipient in the nursing field[3-7].

The perception one has when analyzing information technology in the health field is that it is 15 years behind when compared to other sectors such as banking, industries and aviation[8]. Consequently, as a study field, nursing presents an unfavorable situation in relation to the use of information systems, automation and technological equipment. Given this context, it is important to note that the nursing practice can achieve excellence through the use of information systems. These systems should integrate elements in the context of nursing care as a tool to support the collection of data and generation of new information and knowledge.

In this context, nursing informatics becomes relevant for the care and managerial processes. However, the development of these systems is difficult because they require higher technical qualifications both in relation to nursing knowledge and information and programming technology. Hence, aiming to reduce the problems observed in data recording, nursing care process and methodology, we decided to develop a technology that could aid nursing professionals in the management of their activities.

The Nursing Information System, called SisEnf, is capable of transforming collected data into information that can support decisions by the head nurse concerning the nursing process and managerial data. The system was developed to support nursing administrative activities. It can be used to control planned activities, that is, the nursing care plan and feedback for the administrative cycle that encompasses functions performed by the manager: dimensioning the number of personnel, care systematization, control of personnel and material, and the unit's statistical census, among others.

The SisEnf was also developed to be used in the admission/hospitalization of patients, in the nursing process and management of the nursing service. The SisEnf's results and advantages are evident in the use of patient information, their development and hospital indicators. These results also serve as a source of study for nursing undergraduate and graduate students and students from related areas since the system is implemented in a university hospital.

> The Nursing Information System, called SisEnf, is capable of transforming collected data into information that can support decisions by the head nurse concerning the nursing process and managerial data.

The managerial module allows the head nurse form the medical clinic to search for information necessary to his/her work. Later in the paper, the services offered by the SisEnf in the administrative sphere and how these can maximize the management of nursing units will be explained. Therefore, the SisEnf seeks to establish assessment criteria in order to identify problems in nursing management and recording of patient information.

OBJECTIVE

This study develops a nursing information system to be implemented in the service of nursing care and management in the Medical Clinic at the Lauro Wanderley University Hospital.

METHOD

The study was systematic and constant visits to the medical clinic and meetings with ten nurses allocated in the clinic at the UHLW were carried out. This institution was chosen because it is a health unit of excellence in the education of nursing professionals in the state of Paraíba, Brazil. Additionally, it is developing a process to systematize the nursing process as is established by the Resolution COFEN nº 272/2002[9]. However, this process was formerly manual and nurses were adopting the classification system of the North American Nursing Association (NANDA).

This project was funded by the CNPq through undergraduate research fellowships provided to two undergradu-

Computers in nursing: development of free
software application with care and management
Santos SR

Rev Esc Enferm USP
2010; 44(2):294-300
www.ee.usp.br/reeusp/ 295

ate students, one in the nursing program and the other in computer sciences.

The study's participants were nurses, whose participation depended on their consent and availability to contribute to the study. The recommendations of the Resolution nº 196/96 of the National Health Council, which regulates research involving human subjects, were fully complied with. For this reason, the data collection process was initiated only after the study was approved and authorized by the Ethics Research Committee at the Lauro Wanderley University Hospital (Process No. 063/2005).

Data collection was initiated after the forms used by the nursing service and which compose the patients' medical files were gathered. After analysis of this material, follow-up of data collected by nurses during the process of patient admissions, physical assessment and nursing care plan was initiated. This entire recording was manually performed.

Then, semi-structured interviews were carried out with eight nurses in order to understand their particularities, knowledge and perceptions and to collect information to develop the nursing information system. Meetings were also carried out with 24 professionals with secondary education (nursing auxiliaries) to discuss the information needs that would be put into operation.

The last step in data collection was to consult the sources of information records: notes in the recording book, forms and patients' medical files. For that, the patients' medical files were randomly selected and recording data were compiled in order to verify the notes in terms of the terminology used and the continuity of nursing care.

Data obtained from the observations were recorded as brief communications; ideas, insights, hypotheses or syntheses were described. The use of this information aided the understanding of the nursing work in the Medical clinic at the Lauro Wanderley University Hospital.

The meetings with the nursing staff were held between August 2006 and March 2007 and aimed to understand, from the perspective of nurses and nursing auxiliaries, the elements of their practice, which were obtained through the information system.

Afterwards, units of analysis were identified in order to extract elements of tacit knowledge that could be used in an automated system. With this goal in mind, a database was constructed, which supported the development of a computerized system that could aid the nursing team in the documentation process. MySQL was used in the construction of this database. This is a management system with a high performance relational database, reliable and user-friendly with support for different computer architecture and platforms.

The SisEnf was developed using Java Enterprise Edition (JEE), which is a free programming language focused on objects. It is a multi-platform that can be used in different operation systems[11]. Therefore, the SisEnf can be used with different platforms with no reprogramming costs.

RESULTS AND DISCUSSION

As is well-known, we live in an era of rapid development and innovation in everything related to technology. In the computer field this development is even more evident since developers of software and hardware launch their products and tools in record time after research, analysis and production. Hence, it is necessary to pay attention to the generation of new technology in order to find malleable, appropriate and expandable solutions. With the increasing availability of free software, especially in developing countries, the need emerges to migrate to free solutions and multi-platforms.

Free solutions refer to those freely used, without acquisition and support costs, which contribute to the production of software or an artifact of software that is also free. This is a solution to be legally used without licensing costs. Multi-platforms present the advantage of functioning on different operational systems and hardware configurations. This characteristic defines how complex or rapid the migration of one software to another computer architecture will be.

Brazil is currently a standout because of how it adopts free solutions, especially in the public sector. The growing amount of free software is remarkable. The main focus during the analysis and development of the SisEnf was on being a user-friendly product for its final users, nurses. This procedure took into account the need to accommodate users and the developer as well as the constant changing of functional requirements during the iterative process of development and construction of the software.

For that, we adopted the Unified Process method (UP) that promotes several practices, one of which stands out: iterative development. In this approach, the development is organized into a series of mini-projects of fixed duration called iterations. The product of each mini-project is a tested, integrated and executable system. The iterative cycle is based on refinements and increments of a system through multiple iterations, with feedback and cyclical adaptations as the main propellant that converges into an appropriate system[10].

The result of several meetings with nurses permitted the use of the UP adaptive iteration model in which the application of the Unified Modeling Language (UML) was introduced to construct diagrams and enlist the necessary requirements for system development. The UML allows collaboration among the team members through a standardized language. To develop the UML diagrams pertinent to the project, the JUDE modeling tool was used. This is one of the most powerful free UML modeling tools currently available. It is a multi-platform, simple to use, where

Computers in nursing: development of free
software application with care and management
Santos SR

diagrams have an excellent appearance. Other tools used were: case, WYSIWYG, dbd4 for modeling databases and MySQL[11].

For the programming language, Java Enterprise Edition (J2EE) was adopted because it is consolidated in the job market and is directed at the Web, with already acknowledged benefits. The Integrated Development Environment (IDE) and Eclipse were used jointly with Web Tools Platform (WTP) to develop the web applications. These enabled providing the system with portability, scalability, robustness and performance. Frameworks, components that incorporate reusability to obtain greater efficiency and effectiveness in the development of the system, could also be used.

The forms used for reading only in the SisEnf are those whose period of issue had been expired, and in this case, they were generated with *iText* and *iReport*. These two tools enable the generation of Portable Document Format (PDF) documents. It is characterized by a file format to represent documents regardless of the application, hardware and operational system used to create them. A PDF file can display documents that contain text, graphics and images in a format regardless of device and resolution.

The SisEnf is mainly based on free software technology. MySQL was the Database Management System (DBMS) used. This is the most popular open-coded DBMS in the world. J2EE and tools used in the SisEnf development are all free technology.

Designing the system to meet the needs of nurses was always a goal during its development. The frequent meetings to evaluate the SisEnf preliminary versions allowed the system to be verified and validated during its development. The system was then implemented in the Medical Clinic at the UHLW and then the product was adapted to other needs not previously observed during the construction phase. The tests performed through the use of nurses lasted four months. Nurses and some nursing undergraduate students undergoing supervised training participated in this phase. During these tests, problems related to the operation in real contexts were identified and resolved.

The web server installed in the equipment, and which acts in the SisEnf periphery, is the Tomcat. It is a servlet container recommended in the official reference works of the implementation of Java EE technologies and is used in critical and large-scale applications in several industries and organizations. Because the SisEnf is a web application, it is advanced in relation to common client/server applications. Initially, only one browser (web client – Firefox, Internet Explorer, Opera) is necessary for the use of a system developed on web architecture. Maintenance and updating are easy because the application is concentrated in servers.

The web applications use a multi-level architecture in which the functions executed by the applications are distributed through a network of computers. They use a network infrastructure, which is the current standard adopted by the Internet. One relevant advantage of the applications for the web is based on the fact that regardless of the operational system and browser used, the application can be viewed in the same way by the client. Hence, no adaptation is necessary for other platforms. Moreover, web applications can be used in any place as long a network of computers between the server and the client is available.

Care system

The development of the nursing information system sought to construct a very practical and simple interface, so that the system would be as close as possible to the context of the final user. Its construction was totally based on the practice of activities performed or experienced by nurses in the Medical Clinic at the UHLW.

Based on the tacit knowledge of the context experienced by the nurses, a main screen was developed (Figure 1) to support the flow of information to be gathered or stored in the software. Initially, the nurse enters his/her login and individual password, previously registered in the system in order to be responsible for his/her recording. In this case, all signatures are automatically filled in.

Figure 1 - The SisEnf opening screen

**Computers in nursing: development of free
software application with care and management**
Santos SR

Rev Esc Enferm USP
2010; 44(2):294-300
www.ee.usp.br/reeusp/ 297

OnLine

After logging in and providing a password, the system opens up a new window with a menu and the list of patients registered by the nurse, as shown in Figure 2. In this area of the system, the nurse can see the patient's history, develop a care plan and follow the patient's clinical development. Each record is saved by the system and a new form can be printed and attached to the paper file.

Figure 2 – Screen with menu and list of hospitalized patients

In this interface, when the nurse has the first contact with the patient, she/he will fill in the patient's nursing history. The nurse will select *new patient* in the menu, based on tacit and explicit knowledge. After obtaining the patient's relevant information, the nurse selects the potential nursing diagnoses, whose titles will be indexed under "nurse's observations". Hence, one just needs to select the diagnosis that best fits the patient. The screen with the nursing history presents several variables: patient's identification, hospitalization motive, habits, customs and risk factors. It also presents detailed information about physical assessment for a better evaluation concerning care delivered to patients. This information is identified and analyzed by nurses in order to develop a care plan. It is important to highlight that the medical clinic has already been implementing the systematization of nursing care and the SisEnf incorporated the database of terms of this clinic that were identified in previous studies[12].

Managerial system

This topic refers to the collection of data necessary to the correct implementation of the SisEnf managerial module. Jointly with the care module, it enables a more efficient development of the shift schedule and management of human and material resources by the nursing managers.

The SisEnf managerial module works in the nursing administrative sphere and is integrated into the care module. The first has the resources necessary for the administrative functions applied by the manager and the second supports the first, collecting data necessary to the processing of information used by nurses. The module was developed using the MVC WebWork framework, which is a web application in Java. This module was developed for productivity and simplicity, and was supported by the construction of templates (standard format documents), themes, interfaces with the user, internationalization, validation, among other functionalities. In addition, it was possible to integrate it into the care module.

After extensive discussion between the researchers and the nursing team to answer questions and the relevance of data that would compose the system, we decided to systematize the following documents in the managerial module: unit's statistical census, hospital indicators (rate of hospitalization, average duration of hospitalization, mortality rate, average patients/day), patient classification system, distribution of nursing staff, control of personnel tendencies to compute rate of absenteeism, monthly shift scheduling, social protocol of nursing staff and a text editor for correspondence, according to Figure 3.

298 **Rev Esc Enferm USP**
2010; 44(2):294-300
www.ee.usp.br/reeusp/

Computers in nursing: development of free
software application with care and management
Santos SR

Figure 3 - Screen of the managerial module

CONCLUSION

This work motivated the nurses to implement systematization of care. Actively participating in the project, they realized the importance of using an information system capable of helping them during daily practice. It is worth mentioning that some difficulties related to "political will" were experienced and these are explained by the culture of public services. However, these difficulties did not impede the development of the project, which is already active. Nonetheless, for the nurses of the Medical Clinic to fully use the SisEnf, care and managerial activities need to be recorded daily.

An automated model of information related to nursing practice can certainly benefit health professionals and patients. It enables nurses to spend less time on bureaucratic work, filling in forms and consulting data. This way, they will be more available to deliver a direct and efficient care to patients.

Therefore, we conclude that the SisEnf is a tool that will provide a great help to nursing professionals. It is characterized by a user-friendly, fast, safe and free system that can be used for educational and non-commercial purposes. The SisEnf opens up wide possibilities for research, consultation, and especially exchange of information and experiences, contributing to a better functional performance for nurses and other professionals in the health field. The SisEnf is still in the experimental phase and will be soon evaluated by users who will advance potential corrections and upgrade the system.

REFERENCES

1. Dalri MCB. Assistência de enfermagem ao paciente portador de queimadura utilizando um software [tese]. Ribeirão Preto: Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo; 2000.

2. Évora YDM. O computador à beira do leito. Rev Lat Am Enferm. 1999;7(5):127-35.

3. Évora YDM, Dalri MCB. O uso do computador como ferramenta para a implantação do processo de enfermagem. Rev Bras Enferm. 2002;55(6):709-13.

4. Barros ALBL, Fakih FT, Michel JLM. O uso do computador como ferramenta para a implementação do processo de enfermagem: a experiência do Hospital São Paulo/UNIFESP. Rev Bras Enferm. 2002;55(6):714-9.

5. Lunardi Filho WD, Lunardi GL, Paulitsch FS. A prescrição de enfermagem computadorizada como instrumento de comunicação nas relações multiprofissionais e intra equipe de enfermagem: relato de experiência. Rev Lat Am Enferm. 1997;5 (3):63-9.

**Computers in nursing: development of free
software application with care and management**
Santos SR

**Rev Esc Enferm USP
2010; 44(2):294-300
www.ee.usp.br/reeusp/** 299

6. Sperandio DJ, Évora YDM. Planejamento da assistência de enfermagem: proposta de um software-protótipo. Rev Lat Am Enferm. 2005;13(6):937-43.

7. Santos SR, Nóbrega MML. A busca da interação teoria e prática no sistema de informação em enfermagem: enfoque na teoria fundamentada nos dados. Rev Lat Am Enferm. 2004;12(3):460-8.

8. Raghupathi W, Tan J. Strategic IT applications in health care. Commun ACM. 2002; 45(12):56-61.

9. Conselho Federal de Enfermagem (COFEN). Resolução no 272/ 2002. Dispõe sobre a Sistematização da Assistência de Enfermagem - SAE nas Instituições de Saúde Brasileiras [legislação na Internet]. Rio de Janeiro; 2002. [citado 2007 dez. 2]. Disponível em: http://www.portalcofen.gov.br/2007/materias.asp? ArticleID=7100&sectionID=34

10. Larman C. Utilizando UML e padrões: uma introdução à análise e ao projeto orientados a objetos e ao desenvolvimento iterativo. 3ª ed. Porto Alegre: Bookman; 2007.

11. Costa CGA. Desenvolvimento e avaliação tecnológica de um sistema de prontuário eletrônico do paciente, baseado nos paradigmas da World Wide Web e da engenharia de software [tese]. Campinas: Universidade Estadual de Campinas; 2001.

12. Furtado LG, Nóbrega MML. Construção de banco de termos identificados em registros de enfermagem utilizando a CIPE. Rev Eletrônica Enferm [periódico na Internet]. 2007 [citado 2008 set. 4];9(3):[certa de 25 p]. Disponível em: http://www.fen.ufg.br/ revista/v9/n3/v9n3a06.htm

Correspondence addressed to: Sérgio Ribeiro dos Santos
Rua David Luna, 117 - Apto. 207 - Birsamar
CEP 58033-903 - João Pessoa, PB, Brazil