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FOR A PAPERLESS PHARMACEUTICAL PRACTICE: DEVELOPMENT AND IMPLEMENTATION OF FEEDPHARMA SYSTEM

POR UMA PRÁTICA FARMACÊUTICA SEM PAPEL: DESENVOLVIMENTO E IMPLANTAÇÃO DO SISTEMA FEEDPHARMA

PARA UNA PRÁCTICA FARMACÉUTICA SIN PAPEL: DESARROLLO E IMPLEMENTACIÓN DEL SISTEMA FEEDPHARMA

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ABSTRACT

Objective: To describe the development and implementation of the software FEEDPHARMA, designed for supporting pharmaceutical care (PC) paperless activities related to drug therapy clinical monitoring.

Methodology: Previous documents were considered for the software development, performed through the programming language Java® and Firebird® database access manager. Testing with pharmacists and non-pharmacists end users and appropriate training provided the necessary technical support for daily use

Results: The number of patients assisted at the PC services increased, and the telepharmacy services became more robust. Printed documents are not used since the software was implemented.

Conclusions: The software performance is adequate in providing drug therapy management resources, and may be used for supporting the management of pharmaceutical services.

Descriptors: Software, Pharmaceutical care, workflow.

RESUMO

Objetivo: Descrever o desenvolvimento e implantação do software FEEDPHARMA, planejado para automatizar atividades de atenção farmacêutica.

Metodologia: Documentos impressos anteriores foram utilizados no desenvolvimento, feito através da linguagem de programação Java® e do gerenciador de banco de dados Firebird®. Testes e treinamentos foram realizados com usuários farmacêuticos e não-farmacêuticos.

Resultados: O número de pacientes atendidos no serviço de atenção farmacêutica aumentou, e o serviço de telefarmácia tornou-se mais robusto. Documentos impressos deixaram de ser utilizados.

Conclusão: O software se mostrou adequado para dar suporte ao monitoramento farmacoterapêutico, e pode ser utilizado como ferramenta no gerenciamento de demais serviços farmacêuticos.

Descritores: Software, atenção farmacêutica, fluxo de trabalho.

RESUMEN

Objetivo: Describir el desarrollo y la aplicación Del software FEEDPHARMA, diseñado para auxiliar actividades sin papeles de atención farmacéutica relacionadas con lo uso de los medicamentos.

Metodología: Se consideraron Ddocumentos anteriores para el desarrollo del software, realizado a través del lenguaje de programación Java® y el gestor de bases de acceso Firebird®. Ensayos con los farmacéuticos y no farmacéuticos, los usuarios finales y la capacitación adecuada proporcionó el apoyo técnico necesario para el uso diario.

Resultados: El número de pacientes atendidos en los servicios de atención farmacéutica aumentaron, y los servicios de telefarmacia hizo más robustos. No se utilizan documentos impresos desde que el software fue implementado.

Conclusiones: El software es adecuado para proporcionar suporte a la monitorización del uso de los medicamentos, y puede ser utilizado para la gestión de otros servicios farmacéuticos.

Descriptores: Software, atención farmacéutica, flujo de trabajo.

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INTRODUCTION

Effective management skills are currently required for the delivery of health care in a manner consistent with the organizations' and patients' needs, and for the continuous improvement of patient care outcomes[1]. This has caused an information overflow, and when expertise to analyze such data does not exist, informatics can be explored for specific support.

Medical informatics is generally defined as the application of computers and information technology to health care[2,3]. An increasing number of easy-use softwares have become available for health professionals and their use can save time, reduce costs and improve care provision[1]. More specifically, the possibility of computer support for optimum management of drug therapy has attracted interest, and the implementation of integrated drug management systems has been identified as one of the most important tools of Pharmaceutical Care[1-3].

Pharmaceutical Care (PC) is the pharmacist direct provision of specific health education on drug use for patients, in order to achieve definitive therapeutics outcomes through preventing or solving drug related problems (DRP)[4]. The need for automated systems for PC is clear, once they provide good opportunities for better acquiring and analyzing data about a patient, ensuring drug safety, a major challenge in PC services due to the intricacy of treatment plans and complexity of the medication management process[2,5].

This is particularly important when concerning compounding pharmacies, due to the variety of possible drug combinations and therapeutic regimens, designed to meet specific patients' needs in customized dosage forms, upon receipt of a valid prescription[6,7]. In Brazil, there are still some pharmacies that have not adopted computer-based systems for general and PC services, due to elevated costs of softwares and difficulties for its use by co-workers.

This study aimed to describe the development and implementation of the software FEEDPHARMA, designed for supporting PC activities related to drug therapy clinical monitoring. The development was performed through the programming language Java®, with Firebird® database access manager system. Testing with pharmacists and non-pharmacists end users and appropriate training provided the necessary technical support for daily use. Our results indicate that the software performance is adequate in providing drug regimen management, and may be used for managing clinical pharmaceutical services. Few studies illustrate software development pathways, what makes our study even more relevant.

METHODOLOGY

Software Conception

FEEDPHARMA was designed for supporting feedback monitoring in PC consultations and telepharmacy services, using Windows as the operational system. It allows the registration of a maximum of 500.000 patients. In this paper, we report the experience related to the development focused on the monitoring of vitiligo and psoriasis patients; nevertheless, the software can be explored for other diseases.

Beyond essential demographic information, FEEDPHARMA allows the registration of clinical, pharmacotherapeutic, nutritional and psychological data about patients (table 1). Therefore, the internal printed registration form previously developed for PC and telepharmacy services for vitiligo and psoriasis patients was considered for the development. However, considering the rapid evolution of PS/PC strategies, up-to-date references were selected for upgrading the performance of the system.

Patients, physicians and pharmacists can be easily registered and identified at FEEDPHARMA, and database modifications are restricted to the administrator of the system.

Table 1 – Parameters and main information explored for FEEDPHARMA development

Parameter	Examples of Required Information
Clinical Data	Physician in charge, previous therapeutic strategies explored, laboratorial exams, associated diseases
Pharmacotherapeutic Data	Full description of current treatment: dosage forms, therapeutic scheme, last order, drug interactions, DRP history.
Nutritional Data	Consumption of alcoholic beverages, food with good levels of phenylalanine, fried food
Psychological Data	Clinical history of psychological and/or psychiatry follow-up and diseases, use of psychotropic drugs.

All users are able to register, alter and search for information among the available data. However, Pharmacists and non-pharmacists co-workers have different privileges of access, which are defined and controlled by users' login and password.

The main informatics aspects of the development will be described in simple terms, considering the scope of our paper.

Informatics Features

Generally, a feedback system has three important elements: the controlled object (plant) – in our study, the monitoring service; output controllers - the relatories about a patient's situation generated by the system; and input controllers - the data used to feed the system. During its development different softwares were used (table 2) and the following parameters were considered:

- Object oriented analysis (OOA) strategies were explored. They involve the modeling and the representation of the system to be developed considering all points of view of the stakeholders, i.e., all participants of the software development [9];
- Diagrams of case use (DCU) were developed for gathering data from users for the design of the system in order to address the users' needs, and they are built considering its functional requisites [10];
- Java Database Connectivity drivers (JDBC) (FirebirdSQL Foundation) were used for controlling the database access, in order to make the software more robust [11].

Table 2 – Softwares used for FEEDPHARMA development

Software	Description
NetBeans	Integrated development environment for Java programming language
StarUML	Computer-Aided Software Engineering (CASE) tool for modeling and visualizing all processes' diagrams.
DBDesigner	CASE tool for database modeling and development support
IBExpert	Graphic tool for the management of Interbase/Firebird database
iReport	Generation of relatories and comparison with the database

Tests and Outcomes Assessment

FEEDPHARMA was tested by the developers (α-test) considering the control structure, security, recovering ability, stress, run-time performance and data integrity. Also, it was initially integrated to the software FORMULACERTA (Alternate Technologies, Brazil), the pharmacy's workflow database manager, in order to copy the information about the registered patients, avoiding re-typing.

In the α-test, the computer's minimum requisite for a good

performance of FEEDPHARMA was identified as 512 Megabytes of RAM memory. However, if all 500.000 registers were used, the computer's minimum requisite for a good performance would be 1 Gigabyte.

After such tests, the pharmacy team was invited for technical training and the software was distributed for pharmacists and non-pharmacists co-workers for a β-test. Problem (bug) reports on the use of the software and technical difficulties were collected by self-reported assessments and the necessary changes were executed.

RESULTS AND DISCUSSION

Pharmaceutical services (PS) management should focus on the pharmacist's responsibility to provide clinical services such as PC and the development of the personnel, facilities, and other resources to support that responsibility [4]. The development of specific softwares, although not considered in pharmaceutical sciences curriculum, is an important and strategic resource for improving PS and saving time and financial resources.

Our system was being tested at a compounding pharmacy which provides specific PC and telepharmacy services for vitiligo and psoriasis patients in the year of 2009 and fully implemented in 2010. Due to some modifications on the workflow, regarding particularly the pharmacists, our results are limited to the software impacts on the team workflow during the 1st year of its use, but not direct effects on PS/PC outcomes. More parameters are being used for better analyzing our prototype advanced results, which we plan to publish soon.

Some common difficulties like missing information in basic registration and clinical stages were reported by some of the users (4/10), and they were solved in new training with all the team. Because network configuration, software installation and other technical aspects of the software were previously tested by the developers, problems in these parameters were not experienced by any user. An easy-use interface was available for users after the β-test, and was improved after the training previously mentioned (Figures 1 and 2).

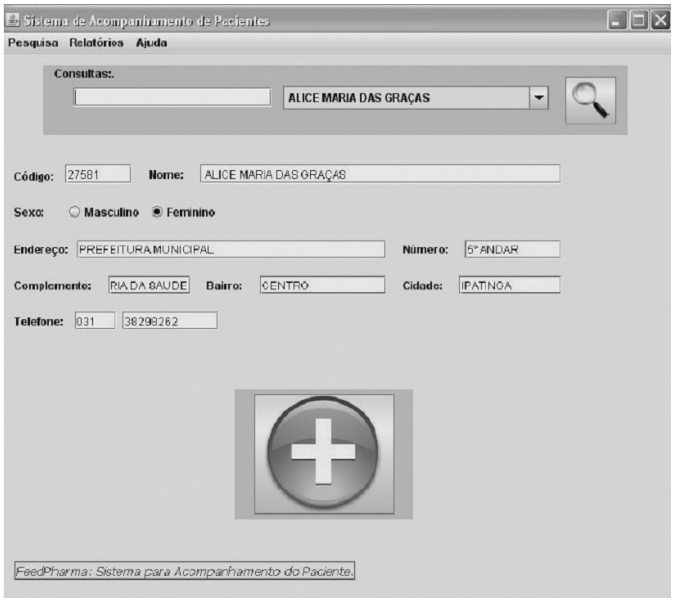

Fig.1 – Interface at the registration stage

The approach for software development regarding drug therapy has usually been limited to one specific disease [1,3]. Although our software was focused on vitiligo and psoriasis patients, on this background of cost-efficient provision of diversified technology health services, we developed a flexible system that might be used for other diseases.

The daily use of the software was established for feedback monitoring work. A better organization and agility of navigation in patients' data was achieved by the pharmacy team after 3 months of use. Printed documents

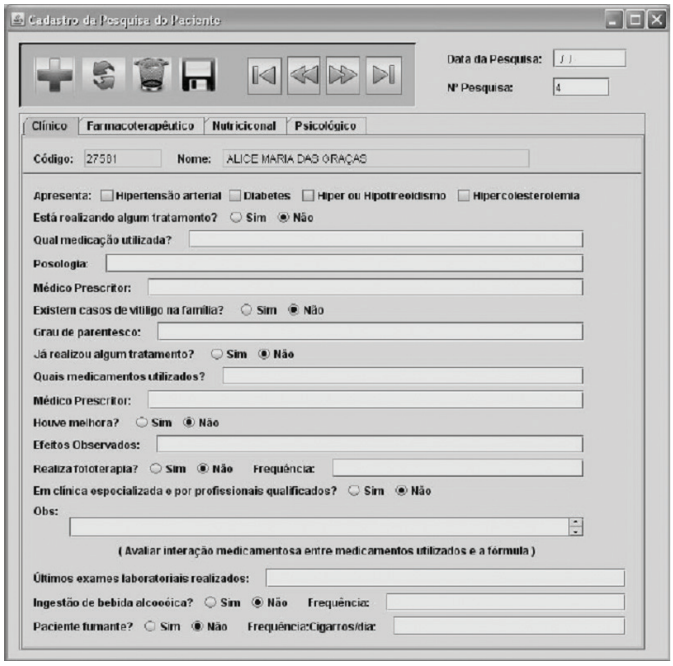

Fig.2 – Interface at Clinical Parameters stage

were no longer used since then, although previous registers were kept, and more patients could be assisted by the pharmacist and attendants.

The number of vitiligo (or) psoriasis patients assisted at the PC services rose from an average of 3/day to 5/day, and the case study stage was also better carried out by the pharmacist in charge, because of the new organization of the information.

The telepharmacy services also improved: important clinical and drug therapy data could be collected and correctly registered by the attendants, in order to give better directions for sales, what was technically difficult when performed previously to the installation of FEEDPHARMA. Moreover, the number of registered patients also increased after the software was installed (data not shown).

Financial savings were among the main results of this study (data not shown). Despite no statistical correlation is demonstrated here, the raised flow of patients, the time saving on PS/PC services documentation stages and the no-longer ordering of graphic services for such documents are the most probable explanations for this result.

Compounded medication management can be technically challenging when performed in printed documents, considering their varied composition, drug interactions, therapeutic schemes and the communication (required for therapeutic success) between physicians, pharmacists and patients. The assembly of important information and the minimization of cognitive and workloads of the team provided by FEEDPHARMA, considered to be key issues for the acceptability of systems, was provided by its standardized form, which makes for consistency in obtaining pertinent information about patients, ensures continuity in overall PS and PC activities and avoids the loss of collected documentation.

The development of a useful PC system is not an easy task. It is not only a matter of using the right development methods and tools, but also of the appropriate tasks for particular situations, once the utility of the system is good only if it can meet the needs of the users. Therefore, the active involvement of potential users is essential for the software design.

CONCLUSION

We demonstrated that information technology can be used to overcome logistical difficulties in providing PS, especially PC. The paperless activities, the minimization of the workload, the increased

number of patients assisted by pharmacists and telepharmacy and the improvement of the quality of such services, and financial savings, are the main results of the implementation of the software.

Despite most of the results are not quantitatively presented, our aim was to describe the development of a flexible software project model and illustrate the pathway used for its implementation. FEEDPHARMA has provided important qualitative results in the first year of its implementation, and its role for PS has become clear after the workflow improvements. At the moment, users are satisfied with its performance.

Our work results, although related to a single inner-city compounding pharmacy, suggest that the availability of an electronic registration of accumulated information about patients may be useful for who usually deal with PS. Further studies are being designed for presenting statistically significant data on the performance of FEEDPHARMA, and validate its use for other diseases.

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