



**DEVELOPING A PROTOTYPE SOFTWARE TO AID THE THERAPY OF AN
ORTHOPEDIC PATIENT USING ANTICOAGULANT DRUGS**
**CONSTRUÇÃO DE UM SOFTWARE PROTÓTIPO PARA AUXÍLIO NA TERAPIA DO PACIENTE
ORTOPÉDICO EM USO DE ANTICOAGULANTE**
**DESARROLLO DE UN SOFTWARE PROTOTIPO PARA AYUDAR A LA TERAPIA DEL PACIENTE
ORTOPÉDICO EN USO DE ANTICOAGULANTES**

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ABSTRACT

Objective: to describe the development stages of a prototype that serves as a basis for future construction of software that enables health care professionals, within hospitals, to provide assistance with a view to the safety of orthopedic patients using anticoagulant medication. **Method:** this study was based on the concept of prototyping lifecycle in its early stages of planning and definition of requirements for future construction of software. **Results:** using the *Microsoft Access*® tool for constructing the instrument had, as a partial outcome, four pages, initially, related to the registration and treatment proposed to be used by the nurse and the physician when providing a patient admitted to the orthopedic clinic with anticoagulant drug treatment. **Conclusion:** the evaluation of this resource as a basis for developing software will be conducted in further studies. **Descriptors:** Software; Health Informatics; Technology; System.

RESUMO

Objetivo: descrever as etapas de desenvolvimento de um protótipo que sirva como base para a futura construção de um *software* que possibilite aos profissionais da saúde, no âmbito hospitalar, prestar assistência com vistas à segurança do paciente ortopédico em uso de medicamento anticoagulante. **Método:** este estudo se fundamentou no conceito do ciclo de vida de prototipação em suas fases iniciais de planejamento e definição dos requisitos necessários para a futura construção de um *software*. **Resultados:** o uso da ferramenta *Microsoft Access*® para a construção do instrumento apresentou, como resultado parcial, quatro páginas, inicialmente, referentes ao registro e à terapêutica propostos para utilização do enfermeiro e do médico no tratamento com anticoagulante do paciente admitido na clínica de ortopedia. **Conclusão:** a avaliação desse recurso como base para construção de um *software* será objeto de estudo posterior. **Descritores:** *Software*; Informática Em Saúde; Tecnologia; Sistema.

RESUMEN

Objetivo: describir las etapas de desarrollo de un prototipo que sirva como base para la futura construcción de un *software* que posibilite a los profesionales de la salud, dentro de los hospitales, prestar asistencia con miras a la seguridad del paciente ortopédico utilizando medicación anticoagulante. **Método:** este estudio se basó en el concepto del ciclo de vida de prototipos en sus primeras etapas de planificación y definición de requisitos para la futura construcción de un *software*. **Resultados:** el uso de la herramienta *Microsoft Access*® para construir el instrumento presentó, como un resultado parcial, cuatro páginas, inicialmente, para el registro y el tratamiento propuestos para uso del enfermero y del médico para atención con anticoagulante de un paciente ingresado en la clínica ortopédica. **Conclusión:** la evaluación de este recurso como base para el desarrollo de un *software* se llevará a cabo en un estudio posterior. **Descriptor:** *Software*; Informática de la Salud; Tecnología; Sistema.

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INTRODUCTION

We have experienced a major breakthrough in technologies related to information and communication, where interactivity and fast communication content transmission increasingly take place. The context immediately preceding the current one, when man became familiar with a new society paradigm, the so-called “information society,” is replaced by certainty of a future based on what is named as new information and communication technologies (NICTs).

The NICTs are defined as technologies and methods to communicate, they are characterized by making information content faster and more parallel, either through scanning, at a simpler level, or through electronic communication in social networks, at a more complex level. This allows, among many other possibilities, capturing, transmitting, and distributing a multitude of data, which are electronically stored and made available in digital format.¹

These technologies have determined significant changes in various fields of human work, such as, e.g. in the health field. These changes led to a new way of organizing the various institutions that deal with services aimed at the integrity of people’s lives. We may highlight, among them, the way how these institutions began to manage the various actions of professionals who work directly and indirectly providing a patient with care.²

There are many examples of interconnection and use of NICTs in the health field, where stand out patient care procedures, management of interventions, distance education as a smart way for ongoing professional training, use of computers to carry out a range of activities required in daily work within the health field, transmission of data in electronic networks about the health of the individual provided with care, both intra and extra-institutionally, among others.

In the health care experience, many issues may rely on the aid of information and communication technologies to facilitate and support decision making, among them the safety of an orthopedic patient using anticoagulant medication.

According to the World Health Organization (WHO), patient safety is defined as reduction of risk of unnecessary harm associated with health care up to an acceptable minimum level. This “acceptable minimum level” refers to what is feasible given the current knowledge of available resources and the context where care is provided.³

Regarding antithrombotic therapy, the Brazilian Society of Orthopedics and Traumatology (SBOT) has established protocols to advise orthopedic surgeons that, in certain surgery types, there is a need to introduce prophylaxis of deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE) by implementing the use of anticoagulant drugs. Thus, a large number of patients are exposed on a daily basis to therapy with anticoagulant drugs and the risks inherent to it.⁴

It is known that anticoagulant drugs cause significant adverse effects when used in an inappropriate way, where the most severe clinical outcome is bleeding. Believing that professional guidance and clarification of potential doubts is a key way to avoid mistakes and generate patient safety, there is continued search for mechanisms to facilitate the practice of health professionals.⁵

A problem in the orthopedic area consists in the absence of an instrument, resource, or some system that helps and allows a comprehensive practice aimed at anticoagulant drug therapy, regarding it not only from the viewpoint of practical implementation, but also in terms of what is related to the prescription of anticoagulant medication, records and/or evolution of information on any changes to the patient, enabling the promotion of a safe practice, delivery of care, and data collection for institutional and statistical purposes, as well as aid to conduct clinical studies.⁶

So, in face of this issue, the study object consists in developing a prototype software to support health professionals in anticoagulant drug therapy for orthopedic patients.

OBJECTIVE

- To describe the development stages of a prototype that serves as a basis for future construction of software that enables health care professionals, within hospitals, to provide assistance with a view to the safety of orthopedic patients using anticoagulant medication.

METHOD

The study method was based on the concept of prototyping lifecycle, as it seems to represent the best approach to develop the software concerned, since it enables the developer to create a model that can be evaluated by the customer before and then deployed. Such an approach begins by collecting and refining requirements and it advances towards the development,

Azevedo DM de, Fontes Filho CHS, Santiago LC.

professional customer assessment, and refinement, when project remodeling takes place, seeking to better meet users' needs before being submitted to product engineering.⁷

For creating the instrument of records, the *Microsoft Access*® tool was used, which is among the most frequently used database softwares available by the market, however, it is not recommended for a large database, because it overloads the system due to high information transfer on the network. It allows a rapid development of applications that involve both data modeling and structure, as well as the interface to be employed by users.⁸

So, initially, the pages for records and identification of primary functions to be fulfilled when developing the future software were designed and developed, allowing us to examine and grasp the overall operation of the instrument.

RESULTS

The creation, so far, of four pages, including access page, home page, and two additional pages for records named as "Medical Assistant" and "Nurse," together, provide a shape to the Health Management System "Anticoagulant Drugs" (HMSAC). The HMSAC, still under development, was primarily drafted with the software *Microsoft Access*®, by using the prompt "File" + "New" + "Data Access Page" + "Structure Mode."

The aforementioned tool also enabled the inclusion of figures to make the page more attractive and compelling. The toolbox allows including the page in the page of text boxes, check boxes, radio buttons, among others observed in various computer programs. After completion of each page, they were saved in the "Hyper Text Markup Language" (HTML), which is one of the languages used to create pages in the internet.⁹

Thus, there emerged the tool to aid health professionals, nurses, and physicians, who work directly with prescription, preparation, management, and administration of anticoagulant drugs, with a view to

Developing a prototype software to aid the...

minimizing errors and a consequent patient safety promotion.

DISCUSSION

◆ Definition phase

The activities concerning the definition phase were conceptualized in three distinct stages, namely: planning, pre-analysis and pre-definition of requirements and review. When developing the planning stage, we identified the primary functions to which the software is proposed. At that moment, there emerged the perception that a multidisciplinary team might be needed, consisting of 1 nurse, 1 doctor, 1 pharmacist, and 1 software programmer/analyst.

The tool of choice for prototype sketch was *Microsoft Access*®, because it enables rapid development of applications that involve both data modeling and structuring and the interface to be employed by users.⁹

Upon completion of the planning stage, the pre-analysis and pre-definition stages aimed at the requirements for further review. In this context, seeking to devise a product that effectively works in nurses and physicians' action to promote patient safety during anticoagulation therapy, the multidisciplinary team met to systematize the initial prototype. This stage culminated in the emergence of requirements specification where the customers and health professionals' needs are determined and identified.¹⁰⁻¹²

◆ Development phase

This phase, with partial outcomes, is based on four pages prepared so far. Next, the prototype software structure is described.

To enter the system, the professional must click on the software link on the computer desktop. Then, the access page opens, where username and password must be entered, as shown in Figure 1.

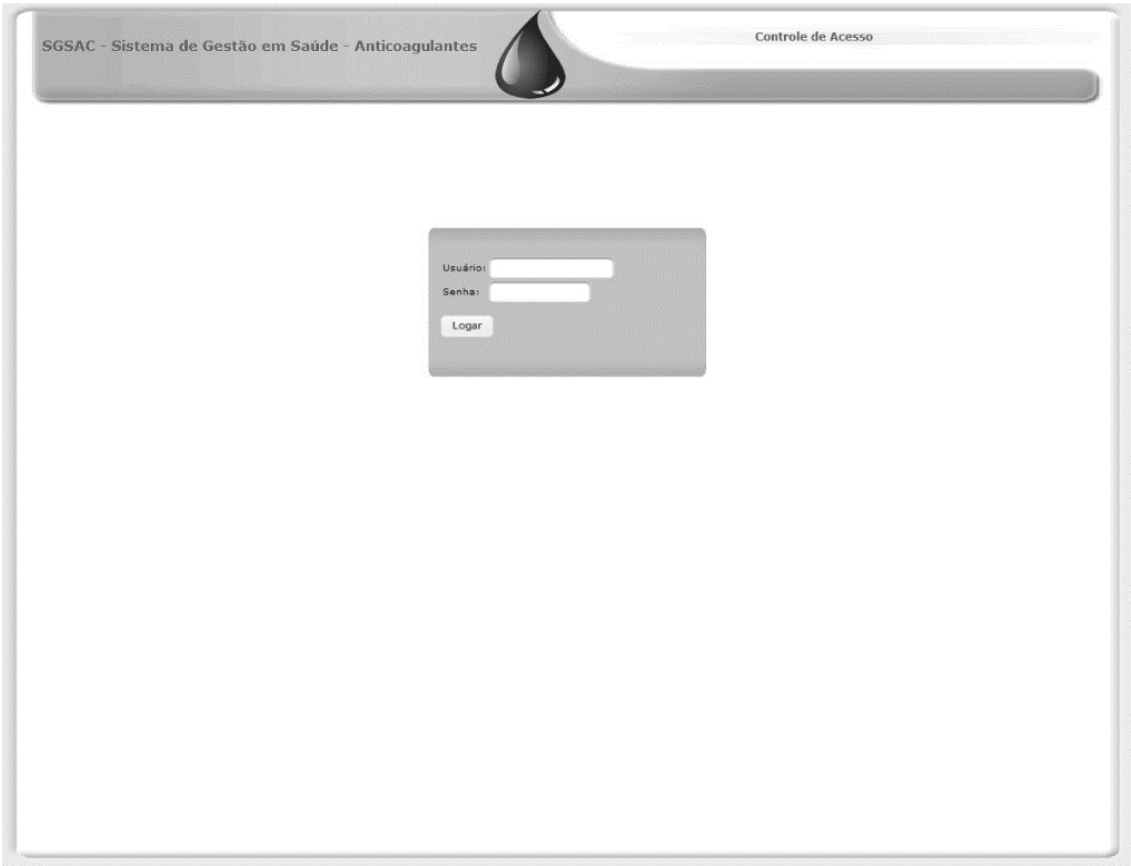


Figure 1. Access page to the Health Management System “Anticoagulant Drugs” (HMSAC).

The software home page will provide the professional with the options to access the electronic medical record of a patient, access the content/activities of the medical assistant and nurse. Secondly, the section related to the pharmacist, administrative staff, and transport of medicines from the pharmacy to the in-patient sector, as well as the return of any medication to the hospital pharmacy, will be developed. The home page also offers the option to exit the system and print the information displayed on screen.

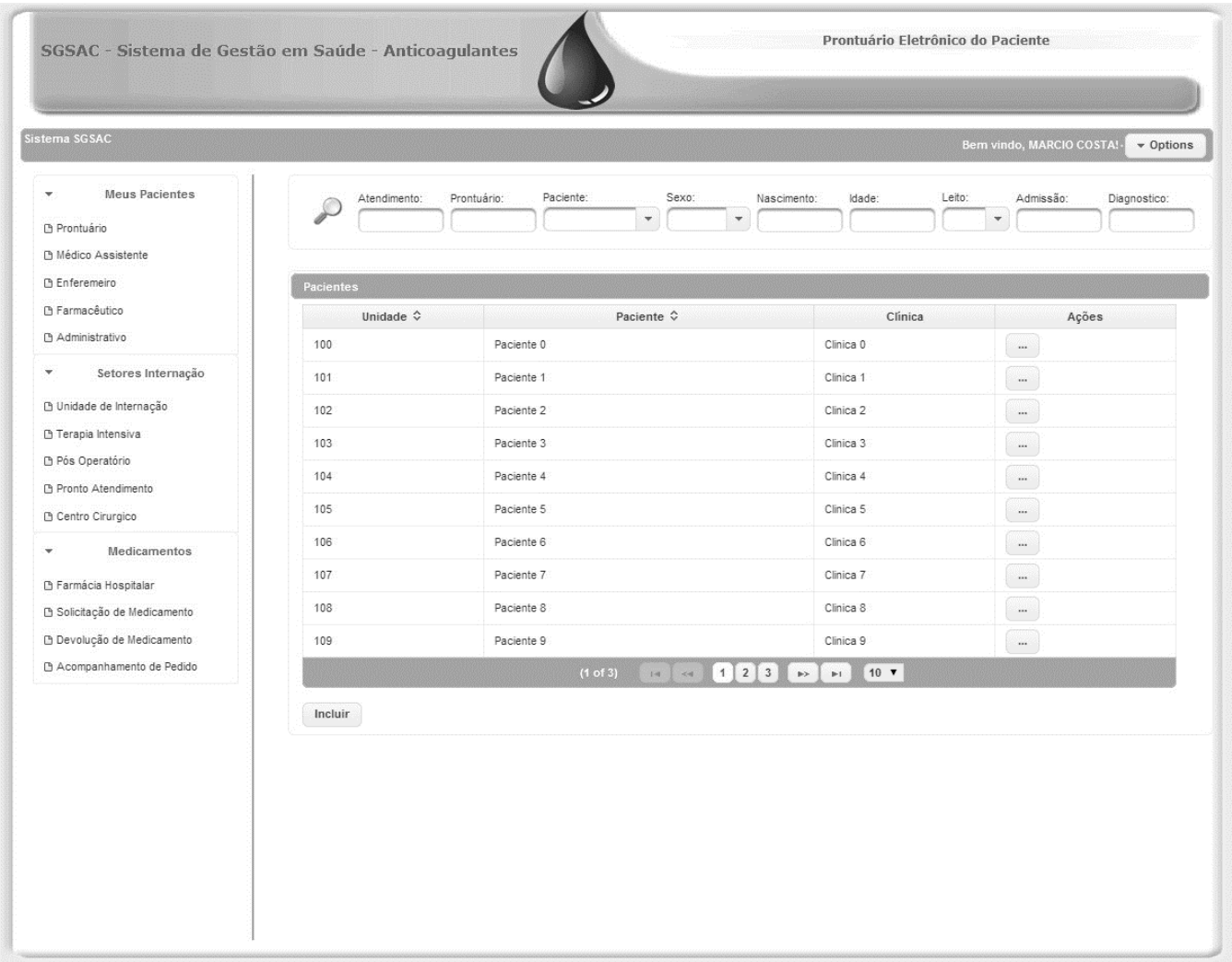


Figure 2. Home page containing the general information of the HMSAC.

Azevedo DM de, Fontes Filho CHS, Santiago LC.

Developing a prototype software to aid the...

Selecting the option “Medical Assistant,” the professional will be directed to another page, with specific information and under the responsibility of the physician conducting patient care. On this page, the link to patient admission and clinical outcomes will be available, both still under development. Below the anticoagulant drug options will be available to prescription, as well as dosage, route of administration, administration schedule, and medicines leaflets, which is a distinguishing feature of the software. Clicking the medicine of choice for

prescription, simultaneously, the leaflet of this drug will be available to clarify any potential doubt of the prescriber. Another differential is the fact that the prototype is designed so that, when filling drug information for use, on the “admission,” this drug is compared to the anticoagulant drug option provided by the prescriber and, if there is any potential risk to the patient related to combination, a “flag” will open, explaining the risk, and this will be viewed by the physician who prescribes drugs.

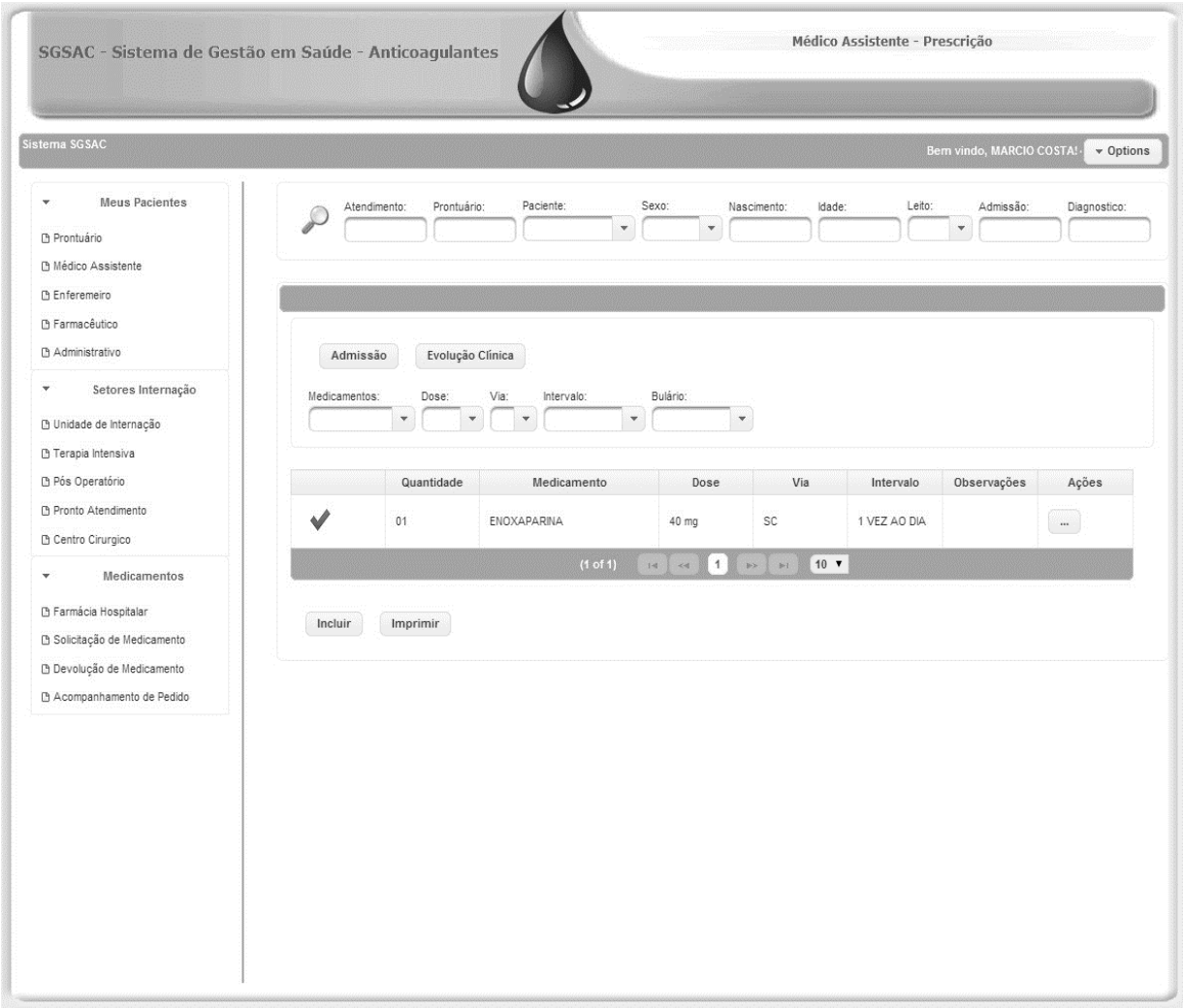


Figure 3. Page related to activities of the medical assistant.

Selecting the option “Nurse,” on the home page, the professional will be directed to another page with specific information and under the responsibility of the nurse who provides patient care. That page provides the link to patient admission, clinical evolution, and health care plan, still under development. Below, a schedule of the drug treatment plan, previously prescribed by the physician, will be available. The system will also allow checking medication, when this is administered to the patient. If the anticoagulant drug has the subcutaneous option, it will be possible to

mark the area chosen for administration. In addition, the option “leaflets,” also observed in the area designated to the nurse, allows clarifying potential doubts in terms of drug handling/preparation and administration. This fact becomes another differential of the software, since it prevents potential errors among professionals, such as, e.g. applying the product at the same site where the last dose was provided or inadequate dilution, in cases of intravenous anticoagulant drug administration, among others.

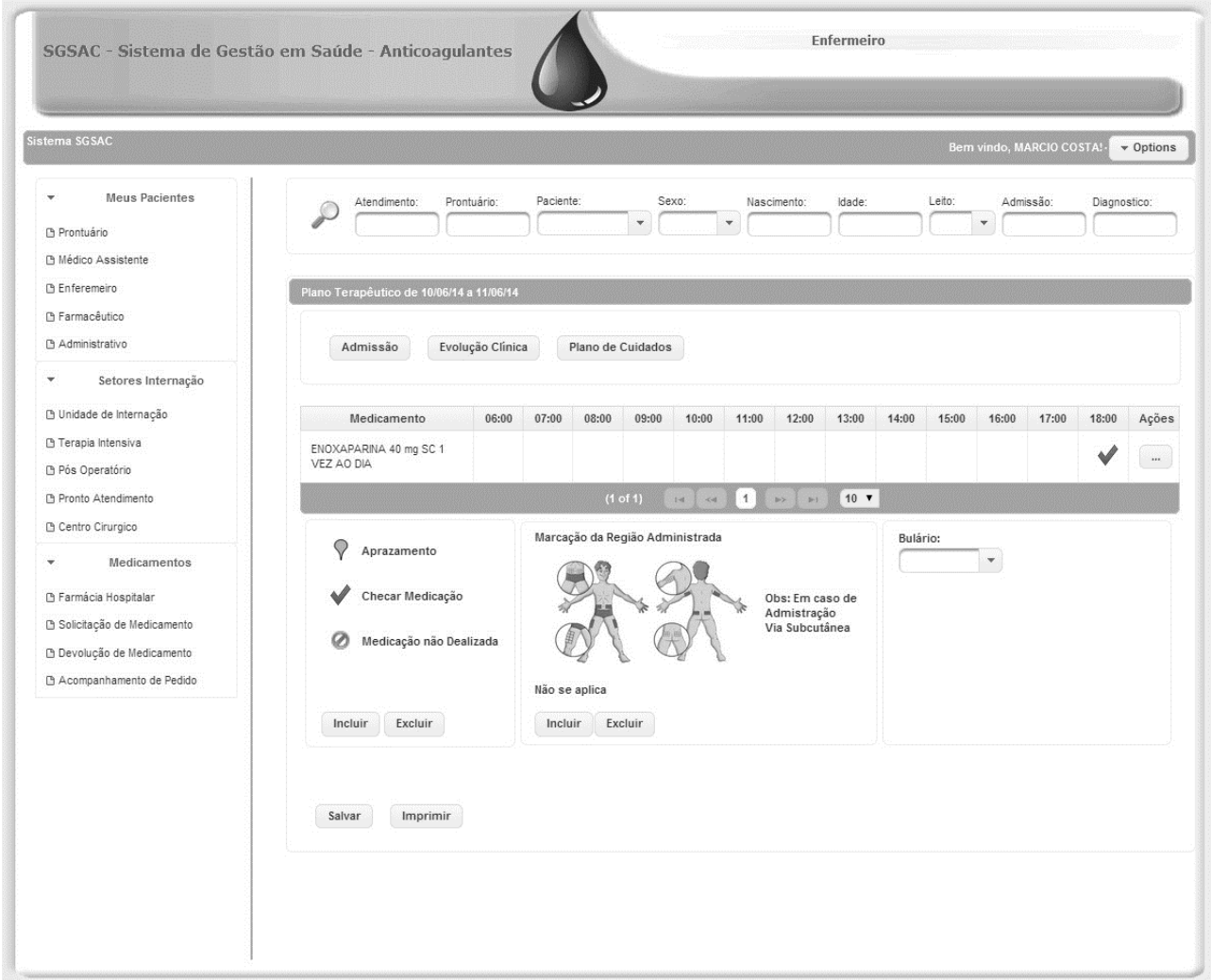


Figure 4. Page related to nurse’s activities.

CONCLUSION

This study primarily aimed to facilitate the creation of a future software, through the development of an instrument to record the actions taken by health professionals when dealing with orthopedic patients in a computerized way, with agility in the process of collecting, registering, storing, and handling data from each of these patients being provided with care under their responsibility, with a view to patient safety and consequent pursuit of minimizing errors in the therapy process with anticoagulant drugs.

Prototyping lifecycle was used in this study, from the perspective of developing a software aimed at therapy with anticoagulant drugs among trauma and orthopedic patients, created by a nurse and relying on active participation of a multidisciplinary team in all phases of its development process.

The object for further research is software deployment in a hospital for pilot study and respective assessment by experts/customers/physicians and nurses. We think this constitutes a breakthrough in the clinical practice of health professionals, since it proposes innovation in relation to the specific look towards a pharmacological group of close surveillance, anticoagulant drugs, and its use among orthopedic patients.

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Azevedo DM de, Fontes Filho CHS, Santiago LC.

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