

## **Presenting EPIDOR: a Management Information System to support Pain Medicine**

## **Apresentando EPIDOR: um Sistema de Informação Gerencial para apoiar a Medicina da Dor**

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**ABSTRACT**

Research on the prevalence of chronic pain in the Brazilian population is still insufficient regarding the electronic recording of these data and their statistical analysis. Considering this scenario, the present article presents a web system for information management on pain management - EPIDOR -, which includes the collection of data from patients with chronic pain and the generation of dashboards from the obtained data. The data collection is performed from two inputs: chronic pain registry from the developed information system and the construction of a digital device - the Digital Survey of Pain - to follow up on the treatment of a specific group of patients. The developed system is in the implantation phase in a regional hospital and the expected result is the mapping of the pain and its epidemiology at municipal level, besides the production of consistent data about the effectiveness of the current treatment.

**Keywords:**Chronic Pain, Medical Informatics, Biomedical Engineering, Database, Epidemiology.

**RESUMO**

A pesquisa sobre a prevalência da dor crônica na população brasileira ainda é insuficiente no que diz respeito ao registro eletrônico desses dados e sua análise estatística. Considerando este cenário, o presente artigo apresenta um sistema web de gerenciamento de informações sobre o gerenciamento da dor - EPIDOR -, que inclui a coleta de dados de pacientes com dor crônica e a geração de painéis de controle a partir dos dados obtidos. A coleta de dados é realizada a partir de duas entradas: o registro da dor crônica do sistema de informação desenvolvido e a construção de um dispositivo digital - o Digital Survey of Pain - para o acompanhamento do tratamento de um grupo específico de pacientes. O sistema desenvolvido está em fase de implantação em um hospital regional e o resultado

esperado é o mapeamento da dor e sua epidemiologia em nível municipal, além da produção de dados consistentes sobre a eficácia do tratamento atual.

**Palavras-chave:** Dor Crônica, Informática Médica, Engenharia Biomédica, Banco de Dados, Epidemiologia.

## 1 INTRODUCTION

The experience of pain is perceived as a hardly expressed and multidimensional phenomenon. It can be defined as an “unpleasant sensory and emotional experience associated with an actual damage or described in such terms”. [International Association for the Study of Pain Press - IASP 1994]. Chronic pain is a public health issue with high rates of mortality, work absence and temporary or permanent incapacity with elevated costs to the health financing sources.

[Sá et al 2009]. According to some research data, around 7% to 40% of the world population might suffer from chronic pain. [Dellaroza, Pimenta e Matsuo, 2007; Fisbain et al, 2007].

There are few studies about the epidemiology of pain at the national level and most of these studies were conducted in specific and selective situations, where pain is researched in specific groups such as: elderly population, workers from some companies and in specialized ambulatory.

[Dellaroza, Pimenta e Matsuo, 2007; Kreling, Cruz e Pimenta 2006; Queiroz, Barea e Blank 2006; Teixeira et al, 2001]. Furthermore, specialized researches on certain body region, not considering the pain phenomenon as a whole, are quite common. Moreira et al (2003) Add the fact that the epidemiologic knowledge about chronic pain in Brazil is based on studies performed in reference centers, and not related to the general population, which should cover all of the country regions.

Given this scenario, research aimed at providing more effective tools to enable more complete and detailed epidemiologic studies on chronic pain in Brazil opportunities arise.

Among these tools, it is possible to develop an information system for the collection and analysis of chronic pain data, that enables electronic recordings of the pain intensity during a period and its correlation with activities and medication schedule, stored in a database for this purpose. Consulting professionals of the field and from

bibliographic research on the theme, it was possible to conclude the inexistence of an information system containing the described functionalities.

In this regard, this article presents a web system for managing information on Pain Medicine, named EPIDOR, which will allow data collection from chronic pain patients and the generation of dashboards from the acquired data.

Management information systems (MIS) assist in a company's planning, control and organizing functions, providing secure information and in a timely manner for decision making. [Oliveira 2008]. The EPIDOR system can be considered a healthcare MIS, since the collected data will allow dashboards generation and statistical analysis containing epidemiologic information on chronic pain. Such informations can be applied in public healthcare strategies and are directly applicable in chronic pain control and in management of resources related to pain treatment, which are expensive to counties, states and federation.

Two data collection strategies were employed in the proposed system: (i) in a common approach to all patients, the pain form validated in Portuguese was used, named Brief Pain Inventory (BPI), a multidimensional tool that uses a scale from 0-10 to measure the following items: intensity, interference of pain in the ability to walk, the patient's daily work and social activities routine, humor and sleep. [Pimenta 1994]; (ii) in a more specific approach to a patients group whose treatment will be monitored, a digital device was built to collect intensity of pain, named Digital Survey of Pain. From such strategies it is possible to assess a more accurate and precise gauging of the pain phenomenon.

It is important to emphasize that the proposed system and the research presented here are part of a project from the UFJF's<sup>1</sup> Medicine and Technology Academic League, which was approved by the brazilian public health system's (SUS) 07/2017 bidding process and it features a group of researchers from the Medical, Computational and Electrical Engineering fields and also students from these three areas who will participate in the system's development, training and implantation processes.

This article is divided in four sections: the first section presents the introduction; the second section addresses the important prospects about management information systems and the decision making process in the healthcare field, specially in the chronic pain issue; The third section demonstrates the EPIDOR system in terms of a developed information system and the Digital Survey of Pain; the fourth section brings final remarks on this research and its future employments.

## **2 INFORMATION SYSTEMS FOR DECISION MAKING IN HEALTHCARE**

Information systems can be useful tools to assist in decision making processes in multiple areas of knowledge, since they allow finer management of the information produced in the organizations in which they were implemented. This trait is also valid for the health field, in which effective information systems provide better action planning in the area by its managers, and that is essential to an area that attends the general population.

In this research, the health subject under study is pain management, which according to bibliographic survey, still lacks in-depth studies on pain epidemiology and the need for generation of reliable electronic data about the patients attended at the Brazilian health institutions.

Pain is a perception modality, therefore, it is about a subjective experience of the consciousness. Thus it can not be mensurated in an objective and precise way by an outside observer. Only the one who feels it is capable of knowing the level of distress and discomfort it causes. For that reason it is important to develop devices through which the patient themselves inform the level and the quality of pain to a system or a database at a given time.

Even though chronic pain is increasing worldwide, it is still underestimated as a poorly known health issue with financial impact and relevance to both public and private healthcare systems, and also as a modifying factor of the population's life quality, once Brazil is still crawling in terms of pain epidemiology knowledge [Carvalho et al 2018]. Chronic pain can be defined as the one that lasts longer than three months after the injury that first caused it, or six months for research purposes, recent studies on this topic have shown that most of the information collected in Brazil goes back over the past 10 years to a prevalence that ranges from 29.3% to 53.3% of the population and is higher in women [Araújo e Vasconcelos, 2018].

Facing this need to map and understand more about pain in our field, information systems are indispensable tools for decision making, as an assessment and control tool by the manager as recommended by the Clinical Protocol and Therapeutic Guidelines for Chronic Pain SAS/MS no. 1083 Ordinance, from October 2, 2012, rectified on November 27, 2015 that revokes the 859/SAS/MS Ordinance, from November 4, 2002. Chronic pain has been pointed out as a public health issue [Andrade 2014], in need of collecting information from the population assisted at the basic health units, informing the manager its real prevalence in each region, state and county, to allow an appropriate response to

each particularity presented within this universe that is the Brazilian Unified National Health System (SUS, in Portuguese).

Based on the described scenario, the Medicine and Technology Academic League study group proposed to develop informatic solutions for collecting and managing the chronic pain data, initially in a regional hospital at the city of Juiz de Fora, Minas Gerais. Such a solutions constitute a managing information web system and a digital device for data collection. This system, named EPIDOR, will act on supporting control of chronic pain and on management of resources related to pain treatments, since it makes it possible to obtain and analyze epidemiological information in this area. The proposed system can be considered an innovation on pain management medicine, for this survey failed to identify any other available systems for this purpose in the field.

It is also important to notice that Epidor is not only a management tool, but it will work as well as an instrument that shows the patient's clinical evolution and as quality control of care and treatment.

### **3 THE EPIDOR SYSTEM**

On this section, the Epidor system is introduced with its two structural components: (i) the web system, used for data collection and management on chronic pain (section 3.1) and (ii) the web application for mobile devices, to be handled by healthcare professionals for collecting data on specific groups of chronic pain patients (section 3.2).

#### **3.1 THE WEB SYSTEM**

EPIDOR is a web system for managing Pain Medicine information with data collecting capability from chronic pain patients and analyzing these data from the dashboards generation. Due to its features, EPIDOR can be categorized as a management information system.

The construction of a web system was an essential requirement for this project, since such a system needs to be accessed by several professionals, working in different health institutions, even though in this research phase its implementation will only take place in a regional hospital at Juiz de Fora. Another advantage from using a web system is the cost reduction for hospitals and other health institutions, with no need to acquire new computers to access the EPIDOR system. Any available computers in these locations can access the system from their installed browser.

In the development of the proposed system, some tools quite common in the area were used: the PHP, HTML and CSS scripting languages and the MySQL relational database. An internet hosting server was also hired to make it accessible to its users. The following Image no. 1 shows the EPIDOR system homepage, on which the healthcare professional has a login access to reach the system’s functionalities, such as: patients registrations, the pain form fillings, consulting on the registered patients’ information and analysis of the data collected at their hospital.



Image no. 1 The EPIDOR system Homepage

Given the importance of this system’s functionality of filling the pain form, the form’s correspondent screen is also featured (in Image no. 2). The image no. 2 shows the interviewed patient’s data (name, medical records, age, etc.) and the information about their pain, such as the human body region with pain incidence and the scales of pain intensity based on the Brief Pain Inventory, data that must be collected by the professional during the interview with the patient.

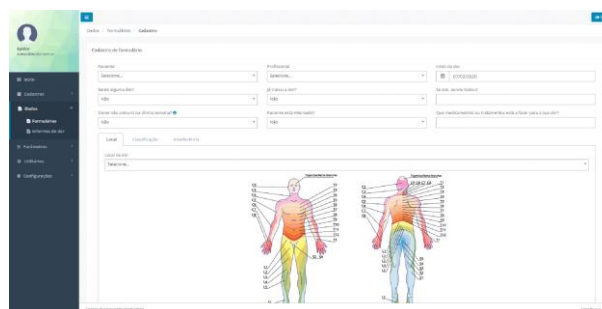


Image no.2. EPIDOR’s Pain Form Screen

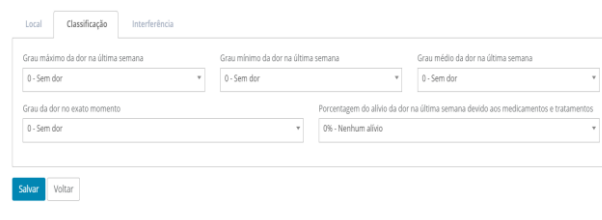


Image no.3 EPIDOR’s Pain Form Screen



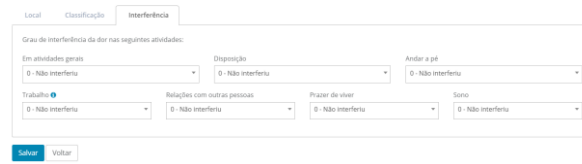


Image no.4. EPIDOR's Pain Form Screen

### 3.2 THE EPIDOR APPLICATION

Besides the collection of chronic pain data through the Pain Form included in the developed information system, the EPIDOR system also comprises the data collection through a web application for mobile devices, whose main goal is to enable a more detailed study on specific groups of chronic pain patients.

With the initiative to follow up on the pain treatment of patients from the public health system, the EPIDOR application (Images 5 and 6) was designed to monitor the patient's pain levels at predetermined moments of the day.

Such application has an easily handled structure, an essential feature for the users who are chronic pain patients. The application stores the information fed by patients about pain levels and medication dosage (if it is oral).

The date and time of the data collection are also stored, once the moment of the tool's usage is crucial to plan a healthier routine for the patient, and to examine the medication's effectiveness as well.



Image no.5 Login Screen and the Digital Survey of Pain Application's Homepage Screen



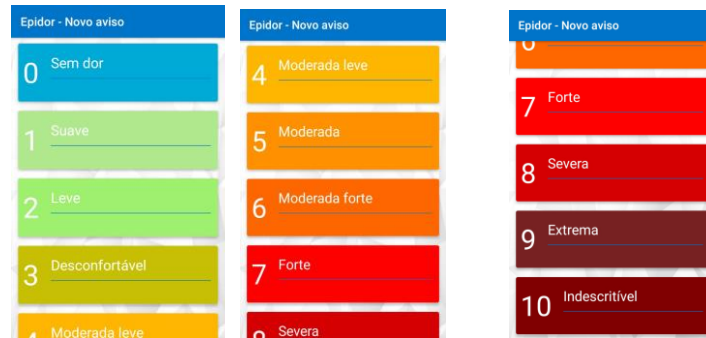


Fig. 6. Pain Level Screen

The EPIDOR application also has the function to alert and monitor the patient regarding the medications, so that by the end of the follow up from home, this application has stored in memory data that shows the evolution of the chronic pain treatment and provides the doctor the capacity to monitor the patient’s daily routine as to actions that influence the pain’s level or nature.

Considering such attribute, the EPIDOR application can be categorized as a support system to clinical decision, that according to Wyatt & Spiegelhalter (1991) consists on active knowledge systems that use two or more data from the patient to generate a specific advice on a case.

## 4 FINAL REMARKS

### 4.1 FINAL REMARKS

Epidemiologic studies that evaluate pain in the form of practical and easily applied questionnaires are important to inform health managers about the impact on the population and also to the control of chronic pain. However, these studies have not been properly conducted yet, due to several methodological obstacles in data collection and high costs to structure a standardized database.

Given the importance of more accurate epidemiological studies in the pain management field, this present research has introduced the EPIDOR system, a web system for chronic pain information management, that allows data collection from patients with this kind of pain and generation of data and statistics from them. As an unprecedented management system in the health field, EPIDOR presents itself as a useful tool for quality assessment of the pain management where it was implemented and consequently a supporting instrument for the decision making processes in managing the pain treatment related resources, which are expensive to counties, states and federation.

The EPIDOR system is currently being implemented in a reference regional hospital at the city of Juiz de Fora, in the state of Minas Gerais. From the conclusion of this implementation and the results obtained from the pain treatment in this institution, the EPIDOR system project can be expanded to other regional and national health institutions, becoming a valuable support instrument to healthcare strategies related to chronic pain management.

As future efforts of this research, besides the EPIDOR system's expansion in other national health institutions, this project anticipates the application of artificial intelligence techniques related to statistical analysis and machine learning to the data stored by the system, as a way of predicting appropriate situations and actions on chronic pain management.

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