

Developing an Implementation through a Modeling of the Database for Cardiovascular Monitoring

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Abstract — The Cardiovascular diseases are the most responsible for the deaths among adults in most of the world. Facilitate the clinical management in primary health care is essential to improve efficiency and to reduce morbidity and mortality. This article describes about a software focused on the management of major cardiovascular risk factors – CRF (diabetes, hypertension, dyslipidemia, smoking and others). After the registration and based in the clinical guidelines, the software can stratified levels of cardiovascular risk. According to the level of risk, provides summary clinical information for management and through the processing of the results of subsequent laboratory tests, monitor the targets for therapies, according to the level of achievement of results, indicates maintenance or intensification of care. There are described and evaluated other systems or outpatient hospital and use of Entity-Relationship Diagrams to subsidized the development of software.

Keywords: *Entity-Relationship Data-Mining, Health*

I. INTRODUCTION

The cardiovascular diseases are the main cause of death in the developed countries (45,6% of all deaths[1]). Given this situation, some software's and other systems were created to try decreasing this, for example Brazilian Society of Cardiology[2] and National Heart Lung and Blood Institute[3]. Despite the practical and easy operation, limited to the calculation of global cardiovascular risk. When seeking grants for the clinical management, these institutions provide only in isolation guidelines for the treatment of cardiovascular risk factors (Diabetes (DM), hypertension (SH), Dyslipidemia) and not in a joint [3,4,5]. Thus, for the primary level of health care as clinics and health units, which support in the approach of the patient, these guidelines do not subsidize their practice properly. Thus, for the primary level of health care as clinics and health units, which support in the approach of the patient, these guidelines do not subsidize their practice properly.

Additionally, the evaluation of the therapeutic results achieved by the patient is the ballast that ensures the quality of treatment and, thus, the clinical results. But beyond the classification of the level of cardiovascular risk, are necessary tools to historical records the results subsequently brought by the patient, seek these results

compared with the targets set and, in a simple and practical; subsidize modification or maintenance of the therapeutic indications.

This paper describes the Quiron (God of Thessalonian medicine and immortal centaur in Greek mythology, had the power of healing hands an that I could not heal, no one else could)

system, which is to automate proposed guidelines for management of cardiovascular risk factors, stratifying their levels and monitoring targets for therapeutic results. It is aimed to support the practice of surveillance, integrated management and maintenance of Diabetes, Hypertension and Dyslipidemia in offices, clinics and health units. It can be operated by all the team of health professionals, according to the level of access and tasks.

II. METHODOLOGY

Initially a search was carried out where it was evaluated software such as hospital and clinical SIAB[6], HiDoctor[7], Tasy[8], SCRAVO[9], WPDHOSP[10] and MedSystem[11]. This measure has theoretical and practical substrate on software available in Brazil in the health area. With the reunion of these subsidies was necessary to carry out. Diagrams Swot (strengths, weaknesses, opportunities and threats of a company. The facility also serves to several other applications.) in some software for a more practical view and detailed, allowing deduce important information for each software.

TABLE I. EXAMPLE OF SWOT SYSTEM

SWOT SYSTEM		
<i>System</i>	<i>Opportunities</i>	<i>Threats</i>
<i>Strengths</i>	Power	Defense
<i>Weaknesses</i>	Greatest weaknesses	Vulnerability

In the same period occurred in which the assessments were interviewed experts in health, where new ideas were added, corrections and referrals, according to the need for each identified as essential to be a helpful and attentive to software standards. These interviews have is that the basis

of clinical software for the new focus on control of cardiovascular diseases and their risk factors. In developing the project, we used Java language (J2EE) to build the software and Oracle Database.

The first software was studied in the search Tasy[8]. This is an ERP offered to hospitals, clinics, imaging centers and laboratories for diagnosis. Was observed and evaluated at the Hospital of the Red Cross, located in the city of Curitiba - Paraná.

The main purpose of this software is to manage more efficiently and provide information to a number of other resources such as administrative and operational.

TABLE II. SWOT TASY

SWOT ANALYSIS		
Tasy	Opportunities	Threats
Strengths	ERP with various resources, including financial.	It allows the creation of new areas within the software.
Weaknesses	Do not have cardiovascular test.	Doesn't not allow the purchase of items to separate the medical kit (bandages, adhesive, tape).

The SIAB (Information System for Primary Care) is the software that currently provides the data collected in primary care of the national health system of our country, the SUS (Unified Health System) and the site of DATASUS [6] can be found an area for download, the software and the manual system.

TABLE III. SWOT SIAB

SWOT ANALYSIS		
SIAB	Opportunities	Threats
Strengths	Many people in database.	Modules can be integrated.
Weaknesses	No integration with ICD (International Code of Disease) or cardiovascular monitoring system.	Built in Clipper, very limited.

The HiDoctor [7] is a tool for performance in the clinics. It has several different areas and can meet in good standard, large-sized clinics. Aims to create specific clinical features, but can work in small hospitals with a certain practicality.

TABLE IV. SWOT HiDOCTOR

SWOT ANALYSIS		
HiDoctor	Opportunities	Threats
Strengths	Mobile Software.	Integration with the ICD and allows the physician to communicate and directly and Indirectly with the patient.
Weaknesses	Electronic Records is similar to Tasy, so, the problems too.	The coverage area of this system is very high and can't specialized in something. Should be a problem in the future.

The MedSystem [11] is a more robust and covers a range of features which can better meet the needs of a hospital. There are clinical tests, exams, occupational medicine, physical therapy, billing and others.

TABLE V. SWOT M^{ED}SYSTEM

SWOT ANALYSIS		
MedSystem	Opportunities	Threats
Strengths	Cardiovascular Tests like Framingham.	It has advice clinics and hospitals.
Weaknesses	Hospitals and clinics only reaches high standard.	In the developer's website, there are a confusion information about the software.

The SCRAVO[9] is a system directed to the management of intensive care. The services offered in the software are: prescription, clinical evolution, general care of the ICU, rates of predictions, of tests, procedures performed, materials used, managed system of databases, access control, assistants to fill, module reports, network, visual interface, integrated with hospital management systems.

TABLE VI. SWOT SCRAVO

SWOT ANALYSIS		
SCRAVO	Opportunities	Threats
Strengths	Management intensive care.	General care of the ICU, prognoses, access control and others.
Weaknesses	Software directed more to the therapy, some shortcomings in cardiovascular monitoring.	Customization modules. It allows the client news areas and can't move forward in the original proposal.

III. HOW TO USE QUIRON

Start up the system with a login and password with differentiation, according to the profile of the user previously registered by the system administrator.

The registration of patients can be done by the doctor or in advance by another professional in the health area. This first register contains information provided by the patient on administrative data and the presence of any cardiovascular risk factor (CRF). The factors considered for the

subsequent equating the level of risk were diabetes, hypertension, smoking, dyslipidemia, male, age greater than 50 years and cardiovascular events in first-degree relatives, when occurring in men under 55 years or women younger than 65 years.

After this preliminary registration, the doctor confirmed that the patient really has the factors listed and the system classifies the level of cardiovascular risk: from low (no or at most a CRF), intermediate (two or more CRF) and high (diabetes, injury in target organ or current cardiovascular disease). Having done this stratification, the levels do not change.

IV. MONITORING TARGETS

To monitor the patient under treatment for one of RCF needs a new consultation. After the first stratification, the doctor asks the necessary examinations and compares with the therapeutic goals. This second moment is a new classification according to the degree of attainment of the goals: Controlled, On Set, or uncompensated, which, respectively, must return at 1 year, 2 months and 1 month to review clinic. This classification can be changed, since the goal of treatment is to achieve the controlled classification.

To facilitate this task and structure in a practical way of care, we used the scheme as Weed called SOAP (subjective, Objective, Assessment and Plan) [19]. The professionals have access to a list of chronic problems that the patient may have the answer to every health problem directly accessed by a click. Thus, the history will be available soon pathological, the result of examinations and specific indications. The list also includes integration with the ICD.

V. RISK FACTORS

Besides being responsible for the insertion of officials and release the correct access, the administrator tells the system what are the benchmarks for the stratification of patients. If the patterns change in some factor, you will not trigger a programmer. The administrator can change the figures, connecting it to your private area. The system then automatically interprets and recalculates the strata. Table V lists the factors CRF and their parameters considered for the analysis of data made by Quiron. For smoking the goal for all levels of risk is complete cessation of smoking.

TABLE VII. VARIABLES CRF

Cardiovascular Risk Factors Levels				
CRF Level	HbA1c	Blood Pressure	LDL CT/HDL	BMI
Low	-	<140/90	<160 e 6	<30
Intermediate	-	<140/90	<100 e 5	<30
High	<7	<130/80	<100 e 4	<25

Where HbA1c is Glycosylated Hemoglobin, LDL, CT, HDL are referring to the levels of cholesterol and BMI is Body Mass Index.

VI. ENTITY-RELATIONSHIP DIAGRAMS

To understand how the information received in interviews with experts were created for entity-relationship diagrams, which we transcribe the content necessary to prepare a model of data. Figure 1 shows the attributes for the first classification (Framingham) and at which level the patient falls, which was not even all attributes related to a better view.

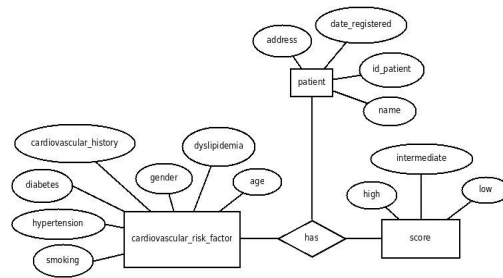


Figure 1. Classification level of the patient according to the Framingham Score

Figure 2 shows the relationship between the classification and the first consultation that the patient must make to nurture a system of monitoring. The attributes of the consultation is complete, we can see a generic field that receives data from additional tests that the doctor can ask for help in monitoring the patient.

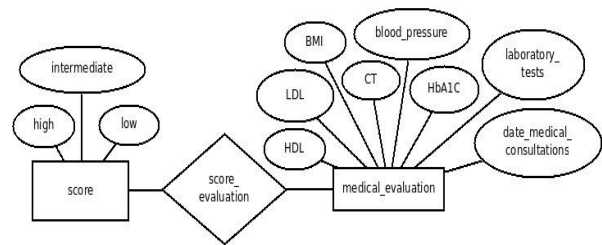


Figure 2. Variables to Classification and Monitoring Patient.

Figure 3 shown the relationship of medical consultations. The system evaluates these attributes according to Table VII and then automatically sorts and displays the date of the next consultation.

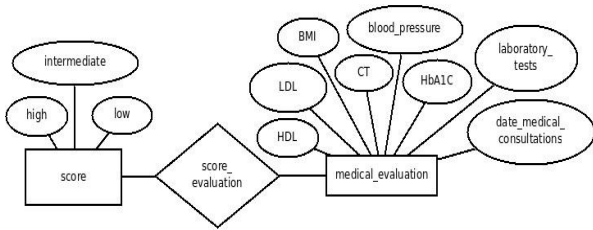


Figure 3. Monitoring of Targets

VII. DATA MINING

The model allows for effective data mining because the design and planning of its type where several algorithms can be processed, as Nave Bayes, SVM, tree algorithms and related rules to discover that hidden in the data stored.

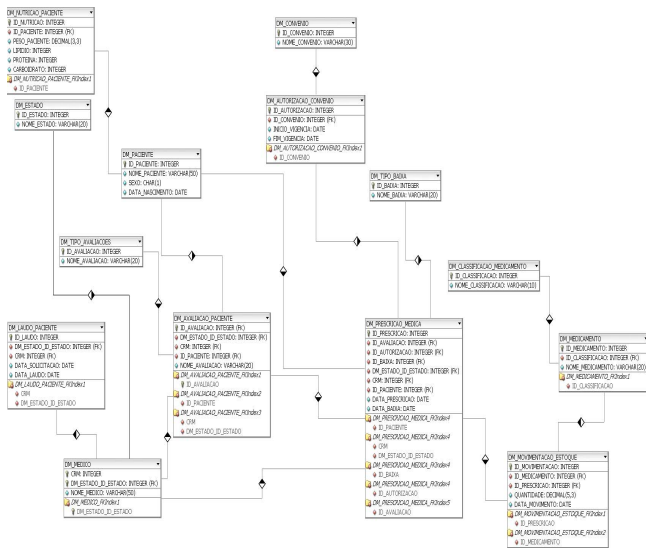


Figure 4. Patient Model[14]

VIII. RESULTS

After the software's analysis a comparison was made to describing the degree of usability and monitoring cardiovascular tools represented in Table VIII.

TABLE VIII. COMPARISON OF SYSTEMS (RATING 1-5)

Comparison Systems		
System	Cardiovascular Monitoring / Capacity	Level of Difficulty to use
Tasy	2	5
SIAB	1	5
HiDoctor	5	2
MedSystem	5	1
SCRAVO	3	3
Quíron	5	3

The Cardiovascular Monitoring Capacity was divided in 1-2 low, 3-4 intermediate or 5 high capacities and the level of difficulty, the highest score represents more difficulty to use. The purpose of drafting the Quíron was practical help and makes the care of CRF.

With its use, it is expected improvement in quality of care of patients under treatment, since it makes easy removal and classification of patients at risk and makes allowances for the integrated management of diabetes with hypertension and dyslipidemia. It also allows the health professional to continuously monitor the effect of treatment, by equating it operates with the results. The deadlines for new consultation, not only organizing the agenda and, in the absence of the patient, alert for patients in need of greater attention to the care. That is, allows the graduation in the intensity of health care. The ease of updating the parameters that subsidize the tests performed by the program could also result in efficiency of services, to adapt to any scientific progress.



Figure 5. Demo of "Final Targets"

As the demo version was used to test a new interface is built with mobility described in the latest tools available for web-design. Figure 5 shows a new area of the system.



Figure 6. List of "Issues"

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IX.CONCLUSIONS

Described facilities are provided by application Quíron, where you can point the main character and that the difference is that the existing classification of cardiovascular risk, provides therapeutic targets to be achieved by each patient according to their cardiovascular risk factors, indicates lines conduct for the management of diabetes, hypertension and dyslipidemia, monitors the therapeutic results with a model that allows data mining and prospecting of rules hidden in the data.

Using this application will contribute to the reduction of morbidity and mortality due to cardiovascular risk factors, and one support the decision appropriate.

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