3º CONTECSI May 31 to June 02, 2006 São Paulo, Brazil

3rd International Conference on Information Systems and Technology Management
3º Congresso Internacional de Gestão da Tecnologia e Sistemas de Informação
11th World Continuous Auditing Conference

De 31 de Maio a 02 de Junho de 2006 – São Paulo/SP – Brasil

DATA WAREHOUSE FOR CANCER TREATMENT: A CASE STUDY IN PUBLIC HEALTH CARE

Antônio Augusto Gonçalves
(MADE/UNESA/INCA, Rio de Janeiro, Brasil) antonio.gonçalves@estacio.br

Mário Jorge Ferreira de Oliveira
(COPPE/UFRJ, Rio de Janeiro, Brasil) mario_jo@pep.ufrj.br

Altino Ribeiro Leitão
(INCA, Rio de Janeiro, Brasil) altino@inca.gov.br

ABSTRACT

Cancer in Brazil is responsible for over one hundred thousand deaths per year. The national health care organization has undergone a series of reforms in recent years and there is a challenge to implement advanced clinical tools to achieve quality. The development of hospital information support systems has long been recognized as a basic element of the process of improvement. The objective of this article is to describe the project and the implementation of a data warehouse for disease management at the Brazilian National Cancer Institute (INCA). The system is a secure access tool to share key information such as test results, orders, schedules and follow-up care. The design intends to bridge the gap between the doctor, the manager and the patient. The primary goal in this implementation is to provide an accurate patient's disease status, in real time. In addition to supporting the combined medical and managerial benefits, this system integrates medical and queue information. The reduction of the patient's waiting time to start cancer treatment plays an increasingly important role in the treatment of this chronic illness.

Key-Words: Data Warehouse, Hospital Information Systems

1.0 Introduction

Health care organizations are now receiving important requests from their customers, government and regulatory bodies that advanced clinical information systems and other related automation must be implemented to achieve the necessary improvement in the efficiency and quality of patient care.

There has never been a more challenging time in healthcare to address the issues of improving the quality using information, knowledge and technology to address the high numbers of adverse events occurring in a cancer treatment center. Health care should be supported by systems that are carefully and consciously designed to produce care that is safe, effective, patient-centered, timely, efficient, and equitable. This environment involves reducing medical errors, focusing on the treatment of chronic illness, and reducing fragmentation in the health care delivery system through the automation of the patient record.

It is clear that advanced clinical information systems will be a driver for quality improvements. Effectively managing data and then translating the data into information will result in substantial benefits. The ability to integrate data to have valuable information will result in a competitive advantage, enabling health care organizations to operate more efficiently.
The objective of this article is to show the contribution of a disease data warehouse in solving health care management problems. The management and integration of key data can provide even more valuable information. The ability to research various conditions, evaluating medical procedures and protocols to define statistically optimal outcomes is an incredibly powerful tool to improve the efficiency and quality in a cancer treatment center.

The subject of this case study is to show a information system which is capable of managing thousands of patients. The objective is to ensure a solution that meets physician's needs but also allows them to leverage extremely valuable information resulting from combining medical and managerial information.

INCA is an agency under the direct administration of the ministry of health, associated with the health care secretariat. INCA has five specialized hospital units and is a large group practice with over 650 staff and physicians-in-training plus an allied health staff of nearly 3,400. The practice sees over 50.000 outpatients per year and has approximately 350 inpatient beds with over 13.000 hospital admissions per year (Gonçalves, 2004).

The project to develop and deploy the computer-based patient record (CPR) components took approximately 3 years. Over a period of several years, the process of documentation has evolved from handwritten, typed notes and reports to the electronic capture of information. Nowadays the electronic environment vision of INCA is to significantly contribute to the success, practice, education, and research through excellence in information management, systems, processes, and technology as shown in Fig 1.

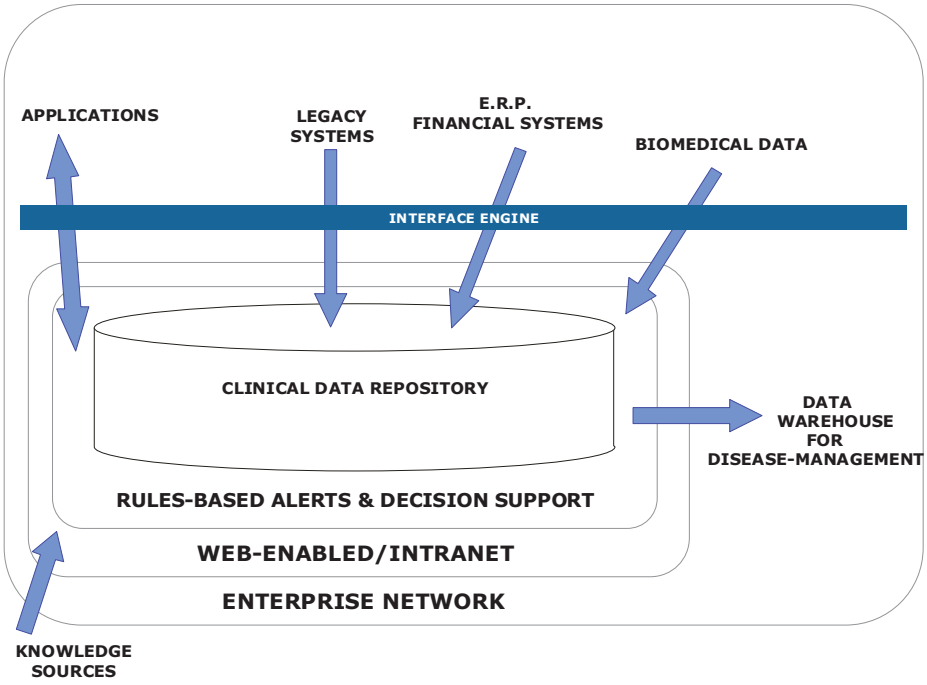

Figure 1. Electronic environment vision of INCA

Using Intranet as a secure access portal, the system allows for secure, selective sharing of key information, such as test results , orders, schedules , follow-up care and support groups. This strategy bridges the gap between what the doctor knows and what the manager knows, between the doctor's record and the patient's personal record. Key benefits of an e-health strategy and using the Intranet include enhanced collaboration between physician and manager, simplified physician work, and empowered managers all using sophisticated, cost-effective Web applications and architecture.

The primary goal in this implementation was to provide an accurate status for the patient, reflecting what would actually happen while he or she was in one of these specialized cancer hospital units. All patients arrived at 7 a.m. only to face a day full of waiting. This feature helps clinicians at INCA utilize resources more efficiently.

The first process eliminated in INCA's implementation was manual data collection. Departments who once maintained their own statistics, now can see standard indicators in real time. The second process was changing the clinic workflow. Historically, patients had to wait for days to be called on for their appointments. With the new design, managers know exactly where they needed to be and at what time, streamlining the process even more.

Some physicians have been apprehensive to employ technology to take over their scheduling. They have a hard time accepting that someone in a different department should plan their day. They have had to give up their secrets and tricks of balancing quality time with patients and administrative workload so that each department could optimize their patient load. With heavy communication and training, they are adjusting to having a set schedule, and have been pleased with the new process.

In addition to supporting the combined medical and managerial benefits, the health unit was interested in providing utilization reporting and trend analysis that integrates medical and queue information. The reduction of the patient's waiting time to start cancer treatment plays an increasingly important role in the treatment of this chronic illness.

By utilizing data warehousing concepts and tools, managers have evolved their capabilities in management of medical procedures. If you are evaluating a clinical information system you need to drill down to a greater granularity of detail. Specifically, you need to know specifics regarding patient's record. This information in the disease and case management is essential.

This ensures that the patient receives an efficient, clinically correct deference by physicians in charge of patient treatment . This system also ensures that the complexity of treating patients for research protocols is being addressed. Finally, using the computer-based patient record helps verify that appointments and exams are scheduled as dictated by protocols for appropriate sequencing.

As health care organizations embark on short and long-term strategic and capital planning, these processes now include a major emphasis on the introduction of information technology to improve patient care. It is apparent that the focus of information systems is shifting from what was once largely financial in purpose to a clinical realm.

2.0 Methodology

From a quality-management point of view, the systems that support disease management represent a significant step forward in measuring and improving longitudinal care. An understanding of how a patient carries out cancer care from month to month or year to year, is not easily obtained today. A well designed disease management tool can impact in different areas such as problem identification, information sharing and logistical support (Drazen, 1995).

Proactive problem identification involves designing alerts and reminders for patients who are at-risk or high-risk state. From a clinical point of view, it should identify the characteristics of members who demand special attention. (Ball,1998)

The power of changing behavior by sharing information about longitudinal patient history demonstrates tangible benefits. The ability of healthcare entities to integrate data will result in a competitive advantage, enabling them to operate more efficiently (Cote,1999).

Logistical support is essential to ensure that the patient with chronic illness like cancer receives an efficient, clinically correct attention by physicians in charge of patient treatment (Sepulveda,1999).

3.0 Results

This software was developed and implemented as a decision support system that became one of the main tools for management of the attendance of patients at INCA. It is being used by directors of the hospitals and its respective command of clinics.

The system identifies the patients who already have been registered and are in roll-out. In this phase the patient is submitted to a series of examinations of pathological anatomy, clinical pathology, radiology, among others, to detect the localization and evolution of the illness.

After these examinations, the localization, stage and diagnosis of the tumor can be identified. Only then can treatment of cancer that corresponds, predominantly, to a surgery, applications of radiotherapy and chemotherapy initiate as shown in figure2.

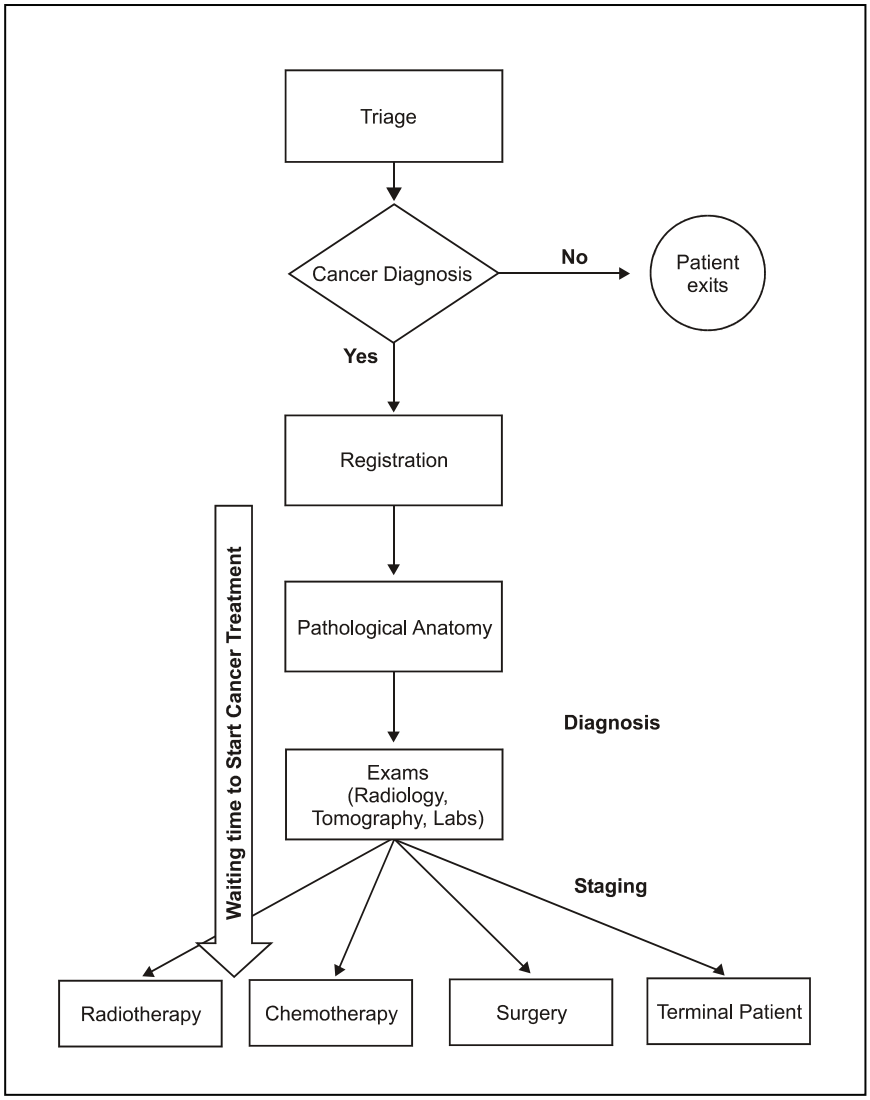

Figure 2. Patient Treatment Flow

The information in the Disease Management System is available from the more aggregated level to the more specific level. The physician can start the analysis from the size of a patient's waiting queue and can go as specific as an exam of a particular patient.

The first available information in the system is the number of patients who are waiting for the beginning of treatment. This information is available for each hospital unit at INCA. It is segmented by 3 hospitals HC1, HC2 and HC3 as demonstrated in Figure 3. All the data presented is fictitious to guarantee the privacy and security of the information on the system.

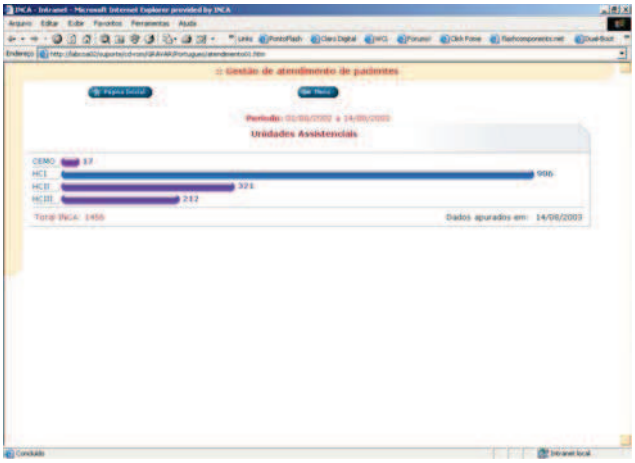

Figure. 3. Waiting list for hospital unit

The manager can select, according to his security profile access, a unit to be analyzed by drilling down to the level of segmentation that shows the size of the queue in each specialty as is shown in figure 4.

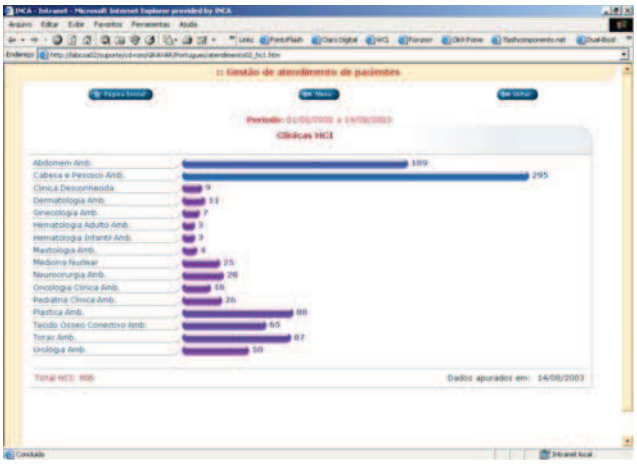

Figure. 4. Waiting list for clinical specialty

The next step is to select a clinic to be analyzed. The manager can evaluate a queue spread through out the previous year , as is shown in figure 5 .

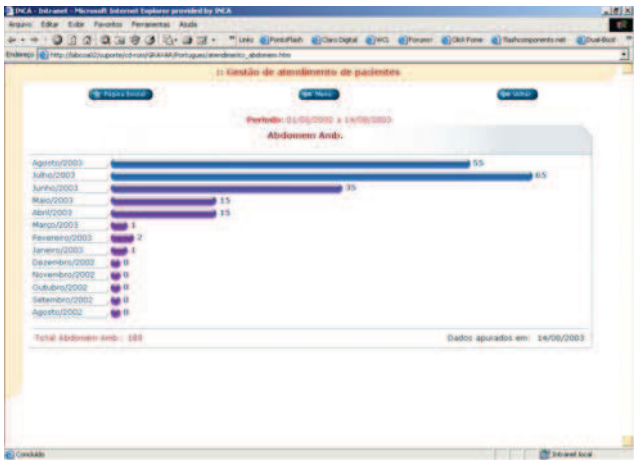

Figure.5. Waiting list for date of registration

From the presented historical series, the manager can select a month of interest and identify patients distributed according to each treatment. Figure 6 shows the number and ratio of patients who have been registered in the selected month.

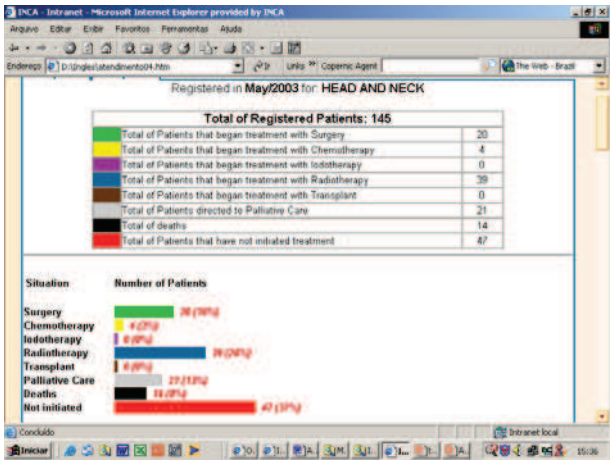

Figure 6. Patients' status

The manager can drill down to a list of patients by selecting a specific treatment as is shown in figure 7.

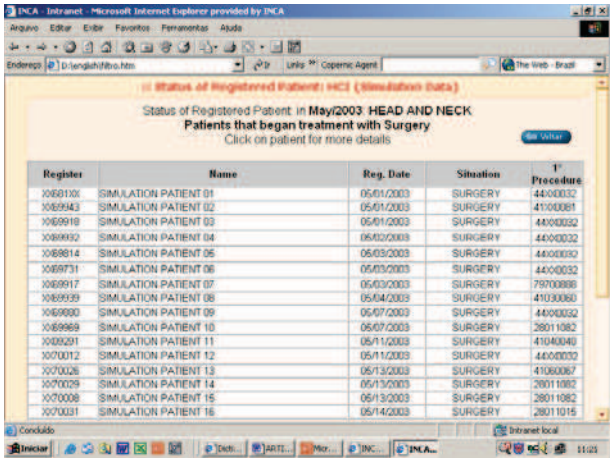

Figure 7. List of patients

From a list of patients, the manager can pick a particular patient and analyse his clinical history**.** By selecting a Electronic Medical Record (EMR), the manager can choose a specific exam for this particular patient, as shown in figures 8 and 9.

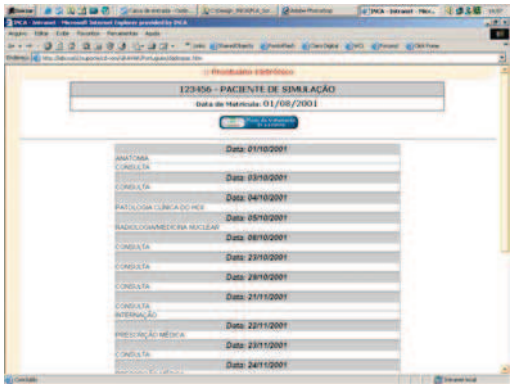

Figure 8. Clinical History

All

Figure 9. Exam's Result

the patients' data is aggregated in a clinical data repository to create a patient's treatment flow. This electronic flow joins medical records and the sequence of events of a patient in only one screen . This approach is totally new allowing doctors to examine clinical evolution of a patient quickly by using past events, current situation and programmed examinations, as shown in figures 10 and 11.

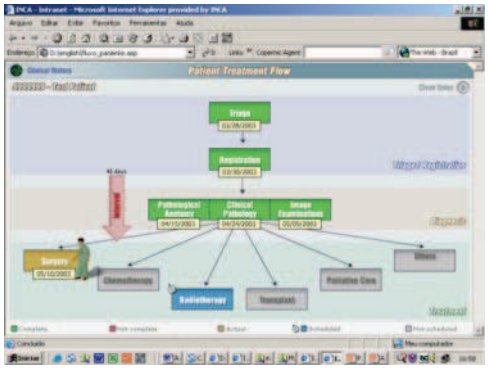

Figure 10. Electronic Patient Treatment Flow

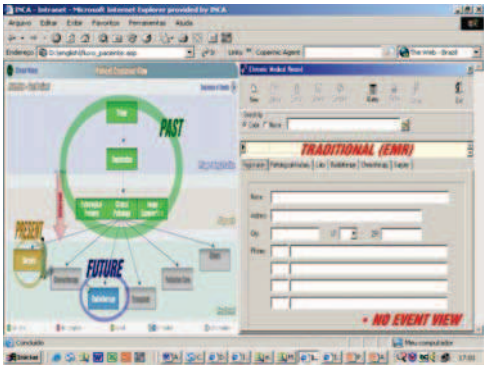

Figure 11. Flow x Traditional EMR

This approach increases "traceability" and is totally patient-oriented. The electronic flow allows managers to investigate where the bottleneck is and then can apply operational research techniques like simulation, as shown in figures 12 and 13 (Gonçalves, 2004).

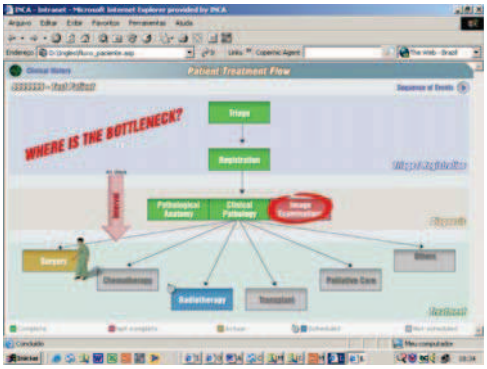

Figure 12. Investigate the Bottleneck

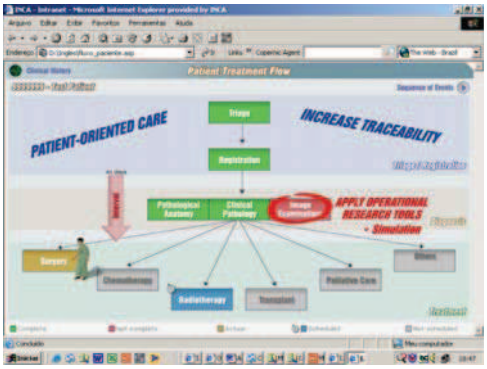

Figure 13. Operational Research Tools

The simulation model represents the patient's flow in the radiology facility to perform image exam and its interaction with the human and material resources (Figures 14 and 15). The focus of this study is the reduction of the patient's waiting time between the image exam schedule and its accomplishment. The target is to increase the capacity to accomplish image exams. Simulation is used to investigate several "what- if" scenarios.

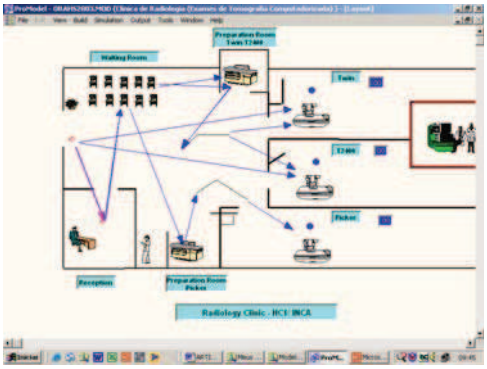

Figure 14. Simulation Model

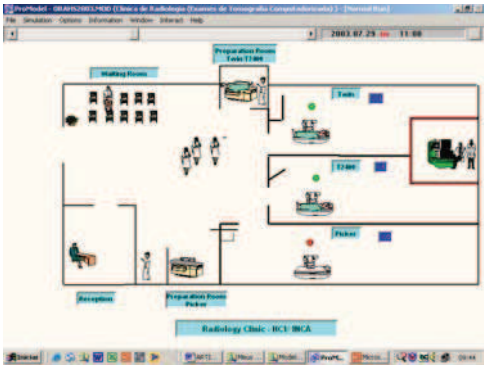

Figure 15. Simulation Experiment

4.0 Conclusions

The creation and implementation of this integrated queue manager application has changed the entire workflow process at INCA. Not only is patient management becoming more organized, but the utilization of resources is improving as well. Despite resistance to change, physicians feel that INCA will prove to be a long-term success. Currently, IT analysts are working toward the integration with other departments. As time progresses, the project measurements continue to show positive results for both the facility and patient.

Future trends will likely include a greater emphasis on disease management and protocols as well as more sophisticated rules and logic as additional types of clinical data become available.

5.0 References

Ball M.J., Simborg D.W, 1998, Healthcare Information Management Systems, second edition, Springer Verlag, New York

Banks, J.; CARSON, J., 1984, Discrete-event system simulation**.** Prentice-Hall international series in industrial and system engineering. New Jersey: Prentice Hall.

Burton T. , Aron D., Goldratt Institute, 2002, "Applying the Theory of Constraints in Health Care: Part1 – The Philosophy" Quality Management in Health Care, ", Vol 10, Número 3 pp 40-52 .

Cote M.J., 1999, Patient flow and resource utilization in an outpatient clinic, *Socio Economic Planning Sciences* 33, pp. 231-245.

Drazen E.L.,J.B., Metzger J.L. & Schneider, .,1995, M.K.,Patient Care Information Systems, Springer Verlag, New York.

Gonçalves AA, De Oliveira M.J.F, 2004, The Use of Simulation to Improve Cancer Treatment Access, Accessibility and Quality of Heath Services, Peter Lang, Frankfurt, pp 149-161.

Kershaww, R., 2000, Using TOC to cure healthcare problems**.** Management Acouting Quarterly, Spring, p. 22-28.

Phipps, B. Hitting the bottleneck**.** 1999, Health Management. United Kingdon.. Goldratt Institute. (www.goldratt.com).

Sepulveda J.A., Thompson W, 1999. The use of simulation for process improvement in a cancer treatment center, Proceedings of the Winter Simulation Conference.