The Impact of Applying Risk Management Techniques to an Electronic Patient Record Project

by

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ABSTRACT

Many health care organizations plan to implement an Electronic Patient Record (EPR) in order to obtain the benefits that these applications bring: improved patient information management, improved quality of service and a reduction in of storage costs for patient records. One of the reasons that Canadian organizations have not widely adopted the EPR is that the implementation process is difficult and features a high risk of failure.

The author participated in an Electronic Patient Record (EPR) implementation project in Chile. The goal of this thesis was to determine whether the application of a normative model of risk management techniques to an EPR project would improve the process of project implementation.

The author used the part of the continuous risk management (CRM) paradigm that corresponds to identifying the risks described in the literature, communicating their potential impact on the EPR project, and designing an implementation plan that takes recommended responses and strategies into consideration. The author conducted a literature search to identify the risks that EPR projects have faced in their implementation efforts and the techniques that had been employed to meet them. The author used documents created during the project to demonstrate the extent to which the project had employed the suggestions that had been found in the literature.

The EPR project in Chile was subject to all of the risks that were reported in the literature as well as risks uniquely related to the Chile project such as a multi-cultural and multi-lingual team, and having to tailor clinical software for a different national health care system. The author found that the recommendations in the literature for how to respond to those risks were useful when drawing up the implementation plan. The implementation process included most of the suggestions made in the literature. The project's pilot phase was evaluated by the client using a study comparing the software's compliance with original client requirements, satisfaction surveys of doctors, patients and staff, and reports of usage levels derived from the database. The project was considered a success and the implementation was expanded from its pilot in two medical centres to include 31 centres located all across Chile.

The author concludes that using the medical informatics literature to identify potential risks and recommended responses, and then employing the recommended responses to generate the implementation plan had a positive impact on the implementation processes in the project as a whole.

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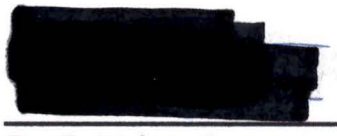

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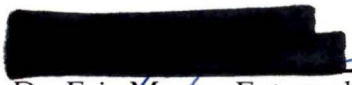

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DEDICATION

To my father, who first showed me how computers can be applied to medical practice.

CHAPTER 1: INTRODUCTION

> *Health care provides some of the most complex organizational structures in society, and it is simplistic to assume that off-the-shelf products will be smoothly introduced into a new institution without major analysis, redesign, and cooperative joint-development efforts. Underinvestment and a failure to understand the requirements for process reengineering as part of software implementation, as well as problems with technical leadership and planning, account for many of the frustrating experiences that healthcare organizations report regarding their efforts to use computers more effectively in support of patient care and provider productivity* (Shortliffe and Boise, 2001, p. 17).

Improved patient information management, improved quality of service and reduced storage costs for patient records are some examples of the benefits that health care organizations are seeking from the implementation of an Electronic Patient Record (EPR). One of the factors that is delaying the adoption of the EPR for many Canadian organizations is that the implementation process is difficult and can feature a high risk of failure. The EPR has been implemented in several health care organizations worldwide, and the experiences of some of those projects have been reported in the medical informatics literature.

The author used the literature to identify the risks that threaten the success of an EPR project, and designed a normative model of risk management techniques that the literature recommended employing during the EPR

implementation process to reduce those risks. These steps correspond to the continuous risk management (CRM) paradigm steps of identifying the risks, communicating their potential impact on the project, and designing an implementation plan taking recommended responses and strategies into consideration.

The author participated in an EPR implementation project in Chile and the goal of this thesis was to determine whether the application of this normative model to an EPR project improved the project implementation process or not.

1. The Electronic Patient Record

Recent medical informatics literature identifies the Electronic Patient Record (EPR) as a very important and beneficial technology that will have a significant impact on health care services and resource allocation decisions once healthcare organizations decide to adopt and implement it. The EPR is an important advance in clinical technology because it:

- Can improve timely access to patient information (clinical and administrative) for medical professionals.
- Can provide aggregate health information for a patient population that can be used to improve the efficiency of planning and management of health care services
- Can allow integration of disparate information systems keeping the patient record as the central focus of the data flow in the systems (for

example, results of clinical laboratory tests and diagnostic imaging tests can automatically appear in the EPR).

- Can be used as financial and legal documents.
- Can improve the ability of investigators to use the patient records' contents for medical research.

The EPR is often placed on a continuum that describes increasing levels of automation in the patient chart. The following list is a description of each stage of automation:

1. Automated medical record (AMR) - Forms are filled out using the computer then the form is printed and filed in the patient's paper medical record.
2. Computerized medical record (CMR) - in this case the paper generated in a patient encounter is scanned and stored in a digital form. The scans would offer little to no search capability.
3. Electronic medical record (EMR) - the user has access to all the clinical information systems from his computer improving the access to patient information.
4. Electronic patient record (EPR) - in this case all the information relevant to the patient encounter including information from external institutions may be included in the patient's digitally stored record. The information is input directly into the system so that it can later be retrieved and used in follow up encounters, research and referrals.

5. Electronic Health Record (EHR) - in this type of record the patient also has access to his record and makes contributions to the contents of the record by complementing the observations and data entry of the medical professionals with background information or additional information deemed useful by the patient.

The EPR consists of all the clinical and administrative patient data generated by an institution integrated in one place, in electronic or digitized form. The physician can use the computer to record the interactions with the patient, and that information, as well as results of further diagnostic tests that have been ordered or other information integrated into the EPR system, can later be accessed by medical professionals to assist them in making more informed decisions about patient care than would otherwise be possible.

This thesis concentrates on the process improvements that can be achieved by identifying the risks and associated responses in the implementation of an EPR at the institutional level. The challenges of implementing an EPR at the regional, national or transnational level would vary widely depending on the unique risks and problems associated with each level. The EPR should be studied in the context of an institution's health information system to appreciate the potential impact that it could have on the way that decisions about care are made at all levels, operational, tactical and strategic. In the past "administrative and financial data were the major elements required for such planning, but comprehensive clinical data are now also important for institutional self-analysis

and strategic planning"(Shortliffe and Boise, 2001, p.4). The clinical data that Shortliffe and Boise are referring to is available in paper-based records, but they are difficult to access and aggregate due to the limitations imposed by indexing and the poor legibility of handwritten documents. The EPR allows the health care organization to integrate its health information systems and to facilitate the flow of data between individual information systems such as laboratory, radiology, supply and financial information systems and the patient record by centering the information gathering on the patient. All processes in a health care organization are related to patient care; it is logical that the information that is collected by an organization be centered on its patients as well.

The result of the centralization of data from disparate systems into an EPR is a more flexible and complete presentation of the patient information. For example, if the EPR is used effectively, the record can be arranged chronologically, by specialty, by medical problem or by episodes of care. The information that is presented by the EPR should aid in decision-making at the point of care. Quality and performance indicators can be generated from the data and used by managers to make resource allocation decisions. Medical guidelines can be implemented and compared to the treatment strategies that the organization's physicians are actually using. Management can be given reports based on diagnoses or treatments, across the institution or for individual physicians or specialties; this is a powerful decision making tool that is not readily available using paper based patient record systems. Access to aggregated

data such as these would allow the organization to perform population-based services planning and management. If health care spending is regionalized, reports based on clinical data will give a more accurate picture of the specific types of medical problems that affect patients in a specific region or population, and can help ensure that the health care resource allocation decisions are made more effectively.

2. *What is an EPR Project?*

What is a project?

Verzuh (1999) defines a project as "work that happens one time only and has both a clear beginning and end" (p. 9) and "a project is unique and temporary but project results may be tangible or intangible" (p. 11). A project will have a goal to strive for and objectives to accomplish in a given timeframe. Projects represent many challenges to their manager. A project manager must deal with personnel issues, estimating costs and schedules, budgeting, authority, controls and communication (Verzuh, 1999). The measure of a project's success is based on how successfully resources such as staff, money and time are managed in the process of meeting the established objectives.

There are three different components for measuring whether the objectives were met. One is whether they were completed on time according to the schedule. Second is whether they were completed within the budget planned for the project. Third is that the product must meet the users' collectively

prescribed expectations of performance (Verzuh, 1999). McConnell (1998) defines a successful project as "one that meets its cost, schedule, and quality goals within engineering tolerances and without padding its schedule or budget"(p. 4).

The implementation of an Electronic Patient Record is a project because it uses the defined resources of time, money, and personnel to accomplish specific objectives such as providing physicians access to patient clinical data in electronic form and integrating clinical information systems.

What is Project Management?

Project management is a series of actions and recommendations designed to minimize the risk that a project will fail, or conversely, it is the process of maximizing the probability that the project will succeed. More specifically, it is designed to minimize the risk that the project will not achieve the objectives that were specified at the outset. All project management activities can be construed as risk management activities (Verzuh, 1999). The project manager must work hard to reduce the uncertainty that is inherent to the project. Reducing the uncertainty about the project as early as possible means that the manager can allocate resources more effectively.

Identification of the risks inherent in an EPR project

3. *Definition of Risk*

> The Software Engineering Institute (SEI) defines risk as the possibility of suffering loss. In a development project, the loss describes the impact to the project which could be in the form of diminished quality of the end product, increased costs, delayed completion, loss of market-share or failure (Williams, Pandelios and Behrens, 1999, p. 3).

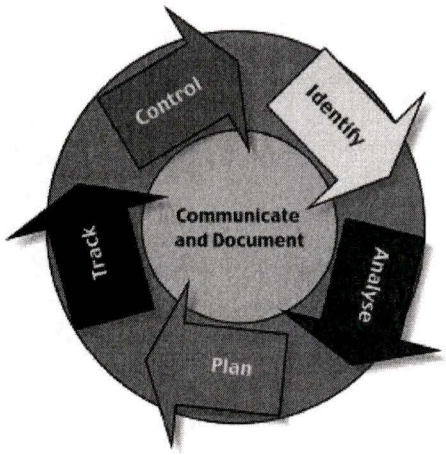
The author used this definition to identify factors described in the medical informatics literature that could cause a measurable impact to the EPR project if they were not taken into account during the implementation process. The author identified how other projects and authors responded to each risk identified in the literature. In general, the risks associated with a project are related to information that is unknown:

- The project team is unaware of the impact of communicating (or not communicating) the project's vision to the participants.
- The project team doesn't know how effective their leadership will be.
- The project team is uncertain whether the make up of the team is the most effective.
- The project team doesn't know how physicians and other users will react to the EPR implementation.

- The project team may not be able to estimate the benefits that the users will experience from using the EPR.
- The project team does not know what the users' expectations for the utility of the EPR are.
- The project team may not know if the EPR meets legal and ethical guidelines for confidentiality of patient data.
- The project team may not be able to estimate the impact to the organization of how the EPR collects data (is it structured and coded, or is it unstructured such as free text).
- The project team may not know how to respond to system failure.
- The project team may not know how long it will take to install a new network system.
- The project team may not know the reaction that a group of users will have to changes in their workflow.
- The project team may not know if the budget pressures on their department will result in the project getting cancelled, or in the case of external consultants, whether the client will have the funds to complete the project.
- There may be uncertainty about how an Electronic Patient Record will improve how an institution functions.
- The project team may not know the most effective way to train the end users how to use the EPR.

The project manager must work to reduce the uncertainty that revolves around each of the scenarios. The project manager will be better equipped to plan his response once the uncertainties have been identified and their potential for harmful or beneficial impact on the project have been understood. This step of identifying uncertainties is one of the stages of the Continuous Risk Management paradigm defined by the Software Engineering Institute (SEI) and illustrated in Figure 1.

Figure 1 The Software Engineering Institute (SEI) Continuous Risk Management Paradigm (Williams, Pandelios and Behrens, 1999, p. 4)



This thesis uses three of the elements of the Software Engineering Institute's (SEI) Continuous Risk Management model (illustrated in the Figure 1) to improve the process of an EPR implementation project:

- Identify - make all known project risks explicit before they become problems,
- Plan - translate risk information into decisions and mitigating actions and implement those actions, and

- Communicate and document - enables the sharing of information amongst project participants and is the cornerstone of effective risk management (Williams, et. al., 1999).

The goal of risk management is to anticipate problems that might occur during the implementation process of a project. Understanding the problems that could occur allows the project manager to communicate the risks to other stakeholders, prioritize his decisions, and take appropriate actions to minimize the chance of project failure. "If a project's stakeholders understand the major issues that determine project success, they can ensure that their project reaches a successful conclusion" (McConnell, 1998, p. viii). The uncertainties expressed in the scenarios above can in large measure be reduced, or at least partially reduced, by using the experiences that other EPR projects have reported in the literature as a guide. Reducing the uncertainties should lead to an improved implementation process.

4. Recommended strategies for dealing with risk in an EPR Project

The scenarios listed in section 3 were derived from the risks reported in the literature as those associated with having negative impacts and causing project failure. The author reduced uncertainties associated with each scenario in section 3 by studying the responses that the medical informatics literature recommended for each one.. The literature reports that including the following

characteristics in an EPR project implementation plan will improve the process of EPR project implementation. The author grouped the characteristics into what he considers the ten most important elements that should be considered to ensure a superior EPR implementation process.

A. Vision

The most important feature that the implementation plan must have is a stable, concrete and documented vision of the future of the organization and the role that the product of the project has in that vision. "Remember to continually align the project with the vision of where you are going, and with the wider organization's vision" (Garside, 1998, p. S14). The EPR should be aligned with the organization's vision and it should be *included* in the vision so that the users see the EPR is a priority for the organization's future. This clear vision of the role of the EPR helps the organization move forward when difficulties arise, and helps determine the right decision to be made when there are other organizational elements competing for resources. The project must fit with the goals of the organization, it must have the support of senior management (Young, 2000), and the implementation must be part of the organization's strategic plan. "Implementing an enterprise [EPR] is big... it should not be seen as merely another information services project. It should be the strategic initiative for whatever period of time it takes" (Goddard, 2000, p. 567).

One of the dangers of communicating the vision of the project is generating exaggerated expectations about the EPR project in the minds of the users involved (especially through rumor and informal communication). When the inflated expectations are not met, the project can suffer a loss of credibility, so it is important to communicate achievable objectives to minimize the chance of that occurring (Gaillour, et. al., 1997).

Another danger with respect to the vision of the project is that the users may not be fully aware of the potential benefits of an EPR project until it has already begun. This gives users the tendency to increase the number or the scope of system requirements as the project progresses. This possibility must be confronted with a document that clearly defines the scope for the project from the outset and is agreed to by all parties. This protects the software provider because changes to an EPR are rarely trivial. They take time, and they take resources, both of which translate into higher costs for the project. If changes are deemed to be necessary, then a formal procedure defining how to request changes and how to respond to the requests for changes (who will responsible for bearing the additional costs) must be created for the project. This step is dealt with in greater detail in the section about project planning and change control (point D).

B. Leadership

The second feature of the successful EPR implementation project is that it will have competent leadership. The leadership must be aware of the vision of the organization at all times, and it must be able to communicate the vision to the decision makers at all levels so that all participants are working towards precisely the same goal.

This leadership must be present in two forms. There must be physician leadership to help convince physicians of the utility of the project (effectively communicating the vision) and to ensure that in the development stage, physicians' concerns are taken into consideration to reduce physician resistance to the project and enhance their involvement at the analysis stage. One recommendation is that "early adopters" (a term from change management literature that refers to people with personalities that embrace change and look forward to it and are looked upon as role models in their organizations) make the best physician leaders in an EPR project because they are enthusiastic about the project and can communicate that enthusiasm to other physicians (Young, 2000). In most circumstances the physician leader will understand the scope of the project and help to ensure that the clinical integrity of the EPR is maintained. The physician champion should:

- Have prestige and clout within the medical community (Souther, 2001),
- Be capable of giving clinical insight to the technical staff,

- Be capable of communicating project goals to other physicians, and help with conflict resolution if necessary (Bruno, Wilson, and VanFossen, 1998. See also Aller, Gibson and Hersher, 1998).

The second form of leadership that should be present in the project is technical and management leadership that can make realistic decisions about the project from the standpoint of technology and resource allocation. Ideally, this leader will have the following personal characteristics:

- The person should be viewed as an authority, have a clear vision of the future of the organization and be able to communicate to all levels of the institution (Goddard, 2000), and
- The person should have excellent social (group process) skills so that they can create consensus and broad support across organizational boundaries (Miranda, Fields, and Lund, 2001).

It should be noted that one leader could meet all of these criteria, but usually in EPR projects the leadership will come from different people, depending on the expertise required.

C. Communication

The third feature of an EPR project that is critically important is that communication at all levels must be unimpeded, complete, candid and relevant. The organization's vision and the project's objectives must be effectively communicated to all participants, as well as the decisions that are made during

the course of the project, and the progress that is being made. The users must be made aware of what is taking place in the organization, and they must be prepared for, and participate in, the changes that occur. The importance of communication cannot be overemphasized. Active communication within the organization and between the project and the organization "decreases surprise, builds excitement, and increases awareness" (Holland, 1997, p. 201). Effective communication about the project is difficult to achieve but will have its basis in fact, it will be of a personal nature (face to face if possible), and it will be done by the direct supervisors of the people affected, not senior leadership (Garside, 1998). One must remember that the actions of the leadership and the organization also communicate a message to the users. "If a culture is to be changed, the leaders must constantly show both the desired direction of change, and that they mean what they say. Organizational policies and actions must reinforce what is communicated. Behaviour must match the rhetoric" (Garside, 1998, p. S13).

The medical informatics, project management and change management literature are in agreement about the importance of the presence of the first three characteristics in an EPR project implementation. With a stable, realistic vision, competent leadership and effective communication, the EPR project implementation will already have the major ingredients necessary for success. The characteristics that follow are described in the literature as effective ways of

improving the EPR implementation process, but without vision, leadership and communication, the chance of an implementation failure is greater.

D. Planning

The project implementation plan is developed in stages. The first stage is the preliminary plan. This is drawn up in part to determine the feasibility or congruence of the project's objectives with the organization's goals. The first step is to define the objectives of the project. The objectives of the project are usually based on a need that the organization would like to see met. The second step is for the project to get the support and sponsorship of management or someone that has the organizational clout to get the project approved and receive a budget. The third step is to begin an analysis of specific needs or problems and begin to define the requirements that a solution might have. This definition of the project scope should be made with defined resources in mind. An example of resources defined at the outset might be "the project must be done in one year with two full time employees and one consultant". Defining the levels of resources available to the project will play a large role in determining how much the project will be able to accomplish.

It is important to note that the requirements definition must be generated in consultation with the end user; otherwise the potential exists for the EPR to meet a need that doesn't exist, or to not consider a need that is fundamentally

important for the organization. McConnell (1998) lists a "Customer's Bill of Rights" that would require a plan to implement:

1. To set project objectives and have the project follow them.
2. To know the project's schedule and budget.
3. To define the software's feature set.
4. To be able to change the scope of the project and know what the cost of that change would be.
5. To know the project's status.
6. To be made aware of risks that the project faces and be provided with options to meet potential problems.

For a project to be able to provide a response to the customer's rights, it is going to have to have an implementation plan. The plan consists of:

- The project scope document where the project's objectives are clearly defined,
- A work plan that is laid out in sufficient detail that the project team understands what is expected of them and when, and
- The documents related to changes tracking.

The project timeline (or work plan) is generated once the requirements have been defined for the project. The team agrees on the work that is necessary to meet the requirements, and then begins to assign responsibility for the completion of tasks to individual members of the project team. All levels of the project (physician leaders, the product vendor, management, and the project

team) should take part in the generation of the work plan so that it can serve as a documentation of the participants' "buy-in" to the project (Souther, 2001). McConnell (1998) suggests that the work plan be published so that the people who are assigned the tasks within its structure can see it and agree to the work schedule being generated for them.

The project team uses the work plan to monitor and report on the progress that is being made. One popular project management software application (Microsoft Project) allows the project manager to input the percentage of a task that is complete. It is reported that the description of task completion should be limited to "complete" (100%) or "not complete" (0%) so that the description is meaningful (McConnell, 1998). This is because it is easy for people to misjudge their task completion levels when they are expected to put a percentage to them. This stage the task has reached is very transparent using this method. The work plan quickly reveals process problems if it is properly defined because it will highlight the tasks that have not been completed in the time allotted, and it can show at a glance where the responsibility lies. The responsibility for the completion of any given task should be assigned to one person wherever possible. This helps to avoid the problem of two or more people thinking that the other(s) will take responsibility for a task and then having the completion of the task delayed as a result.

The project manager and the steering committee use the information about project status to make decisions about how to deal with incomplete tasks.

They can opt to assign another resource to the task, they can decide that the task is unnecessary or they can decide to allow a slip in the schedule to give the person more time to complete the task. It is reported that the key to successful control of a project is communication and that the work plan assists with the communication about the *true* status of the project. This is the information that the project manager and the steering committee need to make decisions (Verzuh, 1999). Once the work plan for the project's tasks is generated, agreed upon, and approved, it is very important that the project team comply with it. The team can generate trust in its ability to meet project objectives by staying on schedule for specific deadlines such as product delivery dates, training, and go-live dates (Holland, 1997),

Verzuh (1999) and McConnell (1998) report that convening a change board is an effective way to provide a mechanism to control changes in the scope, objectives, or requirements of a project. The board should be made up of various stakeholders from the project that understand their role is to discuss the impact of any requested change in terms of cost or time and decide on whether to allow it. The change board must also decide which of the stakeholders will take responsibility for the change being implemented since every change will have an associated cost. It is recommended that the project also control changes to important project documents such as the work plan and requirements document using the same methods.

E. Dealing with Physician Resistance

One of the greatest preoccupations reported by project teams in the literature is the risk of physician resistance to the EPR. The steps outlined previously can reduce the resistance, but there are additional measures that can be taken:

- The project team must seek out physicians' input about the clinical value and integrity of the EPR. Once this is done, however, the team must be prepared to implement the physicians recommendations or be prepared to explain itself if the recommendations are not followed (Bruno, et. al., 1998).
- If there is dissension in the physician ranks about the final choice of an EPR product, or about the functionality of the product it is important to address those concerns at the earliest opportunity. The dissenters can create problems for the implementation team, so creating consensus among the organization's physicians with effective communication and education should be strived for (Miranda, 2001).
- Users regard changes as they apply to them personally, not as they apply to the whole organization. If the physicians can see tangible, personal benefits to using the EPR, they will be less resistant to using it. Demonstrate the personal benefits the EPR system can provide to the physicians at the earliest opportunity (Holland, 1997).

- Conduct a survey of physicians to determine their expectations and needs prior to the implementation. This survey can help the team to identify possible sources of resistance before the implementation even begins. The first point should be kept in mind, however, that the physicians generating the concerns will expect to see transparent responses on the part of the project team (Holland, 1997).
- Physicians will fall into different categories with respect to the coming change: innovators, early adopters, early majority and laggards. Develop strategies for how each group will be handled. The Pareto rule of "80% of the problem is created by 20% of the people" applies when we are dealing with change. Young suggests that it is inappropriate to expend extra resources on the 20% that create 80% of the difficulties. She recommends spending the extra resources on training the best personnel that can help lead the organization through the change (Young, 2000).
- It is easier to implement change in an environment that expects change and creates incentives for the change to occur (Young, 2000). The organization must look at ways of creating a culture that adopts changes without much conflict. It is reported that one way to develop this culture is to have the organization focus on the patient and exhibit the attitude that the changes must take place in order to meet the patients' needs better.

- Compensate physicians for any time that they dedicate to the implementation of the system so that the costs are not unfairly transferred to them (Bruno, et. al. 1998).
- Early adaptors face the largest obstacles. This suggests that the rollout should take place in the clinic where the physician champions are located. The physician champions will be more tolerant of the difficulties and problems that arise in the initial stages of the implementation (Souther, 2001) because they are "early adopters" and recognized as organizational leaders.

F. The Project Team

The project team may be made up of only personnel from the institution or it can include consultants and external personnel. The team should be willing to consider many alternatives for implementing an EPR and it should not begin with the mindset that has determined the entire process beforehand. A multi-disciplinary team can help to ensure flexibility in the team because different professions will view the importance of the EPR differently. The institutional members of the team should be drawn from different departments of the organization in order to help obtain the organization-wide cooperation necessary for the project to succeed (Garside, 1998). In general, the wider the relevant experience the team has to draw on, the more likely that creative solutions will be advanced when decisions have to be made. External consultants can be hired

to provide additional experience and expertise that the organization does not possess internally.

The team should make decisions by consensus wherever possible so that the organization has the broadest possible agreement about the solution chosen. Consensus must also be reached between internal team members and any external members that have been contracted. When organizational conflict arises because of a decision, it should be dealt with immediately so that the success of the project is not jeopardized (Miranda, et. al., 2001). A team that can communicate across professional and departmental boundaries is more likely to be able to create consensus about the project's progress and outcome.

G. Incorporating Information Technology

The project should only incorporate new information technology when it responds to the needs of the physicians and staff in the organization. One of the dangers in an EPR project is the use of "bleeding edge" technologies that seem to meet the needs of the client, but can push a project over budget or past the project's scheduled deadline. Cutting edge technologies create problems for an EPR project because they are frequently unreliable. They may have never been proven in a clinical environment and the project spends extra time trying to make them work, or discovering that they simply don't work in the way that they are being asked to perform. To keep the project from becoming too complex, the team should implement proven and mature technologies insofar as possible.

There are cases where information technologies such as data security and a unique patient identifier are needed to meet the requirements of the institution but they are not easy to implement. The project must learn to weigh these factors when decisions about technology are being made. A technical response must be given for the following challenges:

Data communication - For integration with other vendors systems, a standard messaging system such as HL7 can be used to ensure that applications such as the laboratory information system or the radiology information system can communicate data between each other (Tang and McDonald, 2001).

Data formats – It is difficult to extract patient data from the EPR if it is input as plain text in the record (Stead, Miller, Mussen and Hersh, 2000). In order to be able to easily analyze the patient data after it has been input, it is important to use standardized medical coding schemes such as ICD 10 for diagnosis, or LOINC for laboratory tests, within the EPR product (Tang, et. al., 2001). The data should also be divided into different fields in the data base so it can be indexed according to various criteria and improve the ability of the physicians to access useful information organized in the most appropriate way for the question being asked. An example is that an unstructured text field can include the whole patient chart, but later the physician will have difficulty searching the charts by diagnosis or by medication or by age. Structured data can make data entry faster and the resulting data easier to access, but it can also compromise the doctor's ability to write rich descriptions about the patient's condition. This is the trade-

off in the EPR between structured and unstructured data and the project team must determine the appropriate balance for the organization.

Unique Patient Identifier - "Health systems must also have a unique patient identifier to link all the data on an individual patient accurately and reliably." (Young, 2000) The method of identifying a patient in the EPR system must be such that no two patients receiving care from the institution could possibly have the same identifying characteristics. It is crucial that administrative staff take care to correctly identify the patient with their record to ensure that the patient record being looked at is identical to the patient being seen. This is also crucial when using an EPR because physicians would not want to misrepresent treatment or diagnosis by inputting the information in the wrong patient record. The identification system must be one that is complex enough to meet the organization's needs over time and link all of the patient data, but simple enough to be usable. The organization should be aware of regional and national identification schemes in case there is a future move to integrate health data from wider sources.

Data Security, confidentiality and privacy - Data security, confidentiality and privacy are difficult issues to resolve in a health care institution because they must be dealt with on several levels. Security refers to the safety of the data addressed by real time replication, backups, off site storage, and the physical security of the information system. The organization must deny physical access as well as electronic access to the system for those who are unauthorized to use

it. An EPR can provide technological barriers such as password protection, firewalls, and biometrics such as retina or fingerprint scans but these systems are only as good as the vigilance of the people using them. If the data is handled carelessly, people who want to get access to it, will. On the other hand, these same technologies may create barriers to access in times of emergency where it would be to the patients benefit to make the information as accessible as possible to the attending physician. The institution must draw up policies to address these issues at the time the information system is implemented because the EPR alone may not be able to provide all the security necessary for patient data. This is a canonical case for the need to identify the business rules of an organization prior to beginning the technical portion of the project.

A key data security issue for the organization is that of system failures. System failures are almost guaranteed to happen at some time during the implementation or after, thereby limiting or denying access to the data that has been collected. It is necessary to create contingency plans that go into effect when a problem occurs.

> Organizations can take steps to decrease the risk of [EPR] outages by providing redundancy for everything from computers and disk drives to networks and personal workstations. As a last resort, temporary paper records can act as a backup system until the computer becomes available again (Tang and McDonald, 2001, p. 330).

One must remember that it is not only the patient that is concerned about the privacy and the confidentiality of the data contained in the patient record that expresses their interaction with the healthcare system. Physicians, nurses and other health professionals are also aware that the EPR documents the actions they have taken in the care of a patient and that they can be used as a legal document. Physicians may also be concerned with how the data will be used in an auditing function to compare their outcomes with those of other physicians, or their treatments with established guidelines. Treister (1998) recommends that managers

> Collect and present data responsibly … Draft a policy statement regarding the responsible use of the data. Create a task force that deals with ethical issues, security issues and clearly delineates what type of data is collected and when, if ever, it is released. The issue is primarily one of trust; safeguard that trust at all times (see section "What are some ways to build physician acceptance of the new system?").

Data integrity (data errors) - these can be addressed by a well-constructed EPR application. Validity checks to avoid data errors include range checks, double entry, integrity checks, pattern checks, computed checks, consistency checks, delta checks and spelling checks (Tang, et. al., 2001). The EPR can be implemented such that it constrains and eliminates data entry errors on the part of the user.

Legacy data - A strategy for dealing with data that exists in the previous system must be developed. The institution will have to decide how much of the old data needs to be moved into the new system so as to provide continuity in patient care. This will vary between departments. A strategy must be developed to mine the old system for the needed data, reformat it and put it in the new system. The recommended approach is an incremental one that allows the coexistence of legacy systems with their legacy data while the new systems are brought online. This approach makes the data the important element, not the new application that is replacing the old system (Tuttle, 1999).

Implementation Strategy - The recommended strategy for implementing new EPR systems is to do it in a phased rollout or in stages across the institution rather than suddenly switching systems, which is simpler for the developers but much harder on the users. A phased rollout "... allows for problem identification and problem resolution to be handled on a smaller scale and the resolutions and lessons learned applied to the subsequent implementation phases" (Souther, 2001, p. 53).

This incremental approach to implementing the system can also be useful when the organization is beginning to use the EPR. The functionality of the EPR can be introduced to the physicians in stages so that they have time to learn the system's capabilities in manageable quantities and the advanced functions can be dealt with once the basics have been learned (Bruno, et. al., 1998).

H. Effective Training

The transition to an EPR is often a difficult one for physicians because they are not accustomed to using computers in their everyday practice. The learning curve can be steep because some physicians may have to learn basics of computer operation such as keyboard input and how to use a mouse. Training should be done "early and often" (Treister, 1998). It is recommended that the training be done as close to the go-live date as possible so that the retention of what has been learned is the highest (Young, 2000). Training should take place in stages with the super users and system administrators learning the application first so that they can provide support to the mass of physicians that follow (Souther, 2001).

It is important to realize that physicians do not form a homogenous group. The training should be designed to be as responsive as possible to individual schedules and differing needs for instruction and support . A number of strategies can be used such as formal instruction, videos, computer-based training, and newsletters (Holland and Ortwein, 1997). Also, it should be noted that there are many differences between physician specialties. Each specialty has very different information needs from other specialties. For example

> Primary care physicians found that ... structured note taking, orders, and prescriptions were more practical during the exam room encounter than had been expected... Urgent care physicians required only brief, recent

> medical histories and coverage information (Proud, Howe, Hogan and Spitler, 1998, p. 168).

Training can be more effective if physicians can be grouped according to the information requirements of their specialty.

The final stage of training is user support during the rollout. In that phase, the physicians are attending their patients and have a much higher personal stake in learning about specific functions of the application. Useful strategies for this period are user guides, aide-memoirs and special identification for support staff such as red coats or a colorful button (Gaillour, et. al., 1997).

I. Changing the Organization's Care Processes

The use of an EPR often produces major changes in an institution. The patient/physician relationship is affected. The doctor has to get used to a new way of viewing the patient information and learn new techniques to access the information. It creates uncertainty in the minds of physicians that haven't had the opportunity to work with computers before. It can disrupt the workflow of other workers because there is less reliance on the paper chart, because they are suddenly expected to input part of the patient record, or because they have to deal with new paradigms such as electronic scheduling. The management of the organization can obtain a much clearer picture of what is occurring between the physicians and their patients. It is important to realize at the outset that these

psychological and sociological factors can be more difficult to deal with than the technological factors (Goddard, 2000).

The ideal use of the EPR from the organizational standpoint is for the physician to input his or her activities directly into the chart. This goal is elusive, however, because the physicians consider their time valuable, and so they initially resist the requirement to do the chart input themselves (Tang, et. al., 2001). The potential for physicians to resist this process leads to the recommendation in the literature that the organization use the EPR implementation as an opportunity to look at all of the processes related to patient care. It is not recommended that the organization attempt to replicate the paper chart in its processes because the EPR should have a much broader impact than simply replacing the paper chart with an electronic version (Miranda, et. al., 2001).

Goddard (2000) says that managers in the organization must be directly involved with the project to identify general processes that need to be changed, and to institute the changes to the process beforehand. The EPR project should be seen as the technology that is allowing the general process changes to take place, not as the cause of the disruption. One suggested plan for implementing the new processes related to the EPR is to use them with a paper-based system until the EPR is in place so that staff can get used to how the new process works before introducing more complexity with the EPR (Young, 2000). This is a matter for debate because others believe that employing paper at the beginning will give

users a crutch to lean on in place of the EPR, and so they suggest an abrupt change with little or no tolerance for the continued use of the old system.

It is also suggested that the proposed changes to the work flow be discussed with the project steering committee and that policies and procedures be drawn up for common situations so that they can be incorporated into a manual for use by the staff (Souther, 2001). One must remember to involve a cross-section of the organization's staff so that their input with respect to changes in care processes are heard and addressed. Ideally the project should instill a positive attitude in the organization that encourages a hunger for change and learning, and fosters innovation that will be supported by senior managers in the organization (Garside, 1998).

By incorporating change management techniques, the team can gain a better understanding of the potential impact that redesigned care processes could have on the organization. As Young (2000) says,

> Although managing change is not specifically an informatics issue, understanding the dynamics of introducing information technology into the system of healthcare delivery is of paramount importance to the success of that installation (p. 133).

The project team should analyze both the forces that are at work in maintaining the current state of patient record and the forces that are propelling it to an EPR.

The idea is to reduce the forces that have a tendency to resist the change and focus on the strengthening the forces that support the change.

> The company (or organization) must be awakened to a new reality and must disengage from the past, recognizing that the old way of doing things is no longer acceptable. Next, the organization creates and embraces a new vision of the future, uniting behind the steps necessary to achieve that vision. Finally, as new attitudes, practices, and policies are put in place to change the corporation, these must be refrozen or solidified... change is successful only when the entire organization participates in the effort (Garside, 1998, p. S9).

J. The Impact of the EPR

The EPR project can take years to show results, so it is important to gather data related to system performance during the implementation and maturation phase of the project. "Fact-based reporting is the basis to evaluate goal obtainment and to schedule future maintenance, timelines and feedback on user performance" (Souther, 2001, p. 53). The beneficial results should be demonstrated to staff at the earliest opportunity. For example, you could demonstrate that:

> 1. Necessary clinical data is easily available and obtainable; 2. Access to data is no longer site specific, but available in the hospital or the office, 3. Work lists and reminders are available and electronic mail links providers

> together; and 4. Order sets, order entry and electronic signatures expedite care and improve personal and professional efficiency (Gaillour, et. al., 1997, p. 338).

Souther (2001) says that is difficult it to calculate the value of an EPR. She says that you have to demonstrate the improvements "in quality, customer services, and clinical processes that could not have occurred without [Health Information Technology]" (p. 50).

The reason for demonstrating the improvements attributable to the EPR at the earliest opportunity is to justify the large start up costs of these projects. These costs are not only borne by the organization, they can also be measured in terms of a physician's time away from their practice to learn the new system, changes to a physician's workflow to accommodate the new system and changes in physician/patient relationships (Tang, et. al., 2001). By demonstrating how the EPR is providing a Return on Investment (ROI), the project team can reduce the chances of the project losing support due to financial pressures.

Once the EPR has been implemented, feedback should be sought in order to see how closely the application is matching the needs of the users. Any changes that may be required should be logged and the responses tracked. Gaillor, et. al., (1997) say that in their experience

> The single greatest lesson learned was that when the high volume users were exposed to the system the feedback was rich and bountiful. The

> suggested changes were excellent and, where possible, changes were made to the system quickly enough to engender some confidence in the improvement process (p. 340).

It is also important to point out that there is an opportunity cost for NOT employing an EPR:

> There are four actual [Return on Investment] factors for [Computer Information Systems]. These are reduced labour and benefit costs, reduced unnecessary and duplicate order cost, improved charge capture, and reduced clinical protocol costs (Souther, 2001, p. 51).

A problem that many EPR projects face is that it is difficult to measure the improvements that the EPR has over a paper-based model, but there are many studies that show an EPR can reduce costs and improve quality of healthcare services (Tang, et. al., 2001).

In the medical informatics, change management and project management literature, the ten points outlined above are suggested as strategies for improving the process of EPR project implementation. The remainder of the thesis is devoted to determining the applicability of this normative model to an EPR implementation project in Chile.

CHAPTER 2: HYPOTHESIS

The application of risk reduction strategies can improve the process of introducing EPR projects into a clinical environment. Risk management techniques were applied to an EPR project in Chile and the process of the project is compared to that reported in the literature.

The purpose of this thesis is to show the extent to which the application of risk reduction strategies did improve the implementation process of an EPR project.

CHAPTER 3: METHOD

The author participated in a consulting project that implemented an EPR in two medical clinics in a private health care organization (comparable to a Health Management Organization [HMO]) in Chile. The pilot project formed the initial stage of a plan to implement an organization-wide EPR that could be accessed from any one of thirty-one medical centres located throughout Chile. A normative model of risk management techniques was applied during this project and the process and outcome of the project were compared to that reported in the literature.

3.1 Participants

The full-time participants in the project were:

- The Chilean healthcare organization team consisting of the medical project manager (Chilean physician), the technical project manager (Chilean computer engineer) and a nurse consultant (Chilean).
- The external consultant team consisting of the author (Canadian technical consultant and trainer), the project manager (Uruguayan), technical support person (Chilean), and one or two consultants in support roles (Chilean).

The part-time participants in the project were:

- The General Manager of Health in the organization (Chilean, member of the steering committee)
- The Chief Information Officer (Chilean, member of the steering committee)
- Manager of the department of Medical development (Chilean, member of the steering committee and project direction)
- The Global Director of healthcare consulting (Argentinean, member of the steering committee and project direction)
- Regional manager for the computer company that had won the contract and subcontracted the implementation to the consulting firm (Chilean, member of the steering committee)
- Various experts as required: Database Administrator (Chilean), Senior Technical Consultant (Argentinean), Human Resources Department, Legal Department, Help Desk, Application programmers (Spanish)
- The applications' users, which included the administrative staff, receptionists, nurses and physicians.

3.2 Materials

The materials used to identify how risk management techniques can impact the process and outcome of an EPR project are as follows:

1. Medical Informatics literature that identified risks that could potentially be encountered in an EPR implementation project and possible reactions to those risks.
2. Project management literature that generalized those risks and reactions for other types of projects.
3. Change management literature that generalized those risks and reactions for other types of projects.

The documents that were used to measure the impact of incorporating risk management techniques in the implementation process are as follows:

1. Project working documents created during the project that documented the actions taken and the decisions made during the implementation process. The original documents were the minutes taken during the committee meetings and are in Spanish. The author extracted those portions of the documents that pertained directly to the EPR implementation and translated them into English (see Appendix 1).
2. Data from a survey to determine physician attitudes and concerns prior to the implementation of an EPR in one of the medical centers. The original survey was designed and administered by the author in Spanish. The author translated the survey (see Appendix 2) and the results (see Appendix 3) into English.
3. Data that was recorded during the initial three months of the project to identify the amount of use the information system was getting from staff

and physicians. The EPR application automatically changes the status of the patient during the course of their visit to the clinic. The database was queried at the end of each day to determine whether the professionals had performed the required actions in the EPR. The results are summarized in Figure 3.

4. A report written at the end of the pilot phase using surveys to determine the level of satisfaction that physicians, staff and patients had with the new system. The client team did this report internally for their CEO. Their findings were that the pilot project was a success and recommended continuing with the following phases of the project.
5. The results of a report commissioned by the CEO from an external firm that also concluded that the project was a success and recommended continuing with the next phases of the project. The author was not given access to the contents of this report.

3.3 Procedure

1. The author participated in an analysis of the health care organization to determine the impact that the EPR application would have on the care processes of the organization.
2. The author participated in the EPR implementation project as a consultant. The author was present for every phase of the pilot project including planning, application design, application configuration, user

training and support. The author was also present in the majority of committee meetings and observed how decisions were being made about the project at the highest levels of the organization.

3. The author reviewed the literature related to the implementation of an EPR to identify key risks for project failure. Initially only the medical informatics literature was consulted, but later that was broadened to include change management literature and project management literature once the author realized that there was significant overlap in the three areas of study.
4. It should be noted that the author consulted much of the literature written prior to 1999 during the course of the project, and therefore incorporated many of the recommendations found in the literature in the day-to-day process of EPR implementation. As problems arose, the author consulted the literature to see what past responses had been. Literature that was written after 1999 is included in the thesis to compare the author's experience with those of projects that took place during a similar time frame.
5. Once the project was complete, the author returned to the literature to see what was reported and how it compared to the experience of the project in Chile.
6. The author identified all the risks reported in the literature and placed them in the first column of a table. In the second column, the author

placed quotes from the literature that clearly expressed the risk. The third column was devoted to the risk reduction technique reported in the literature that was used in a previous implementation plan for other health informatics projects. A study of the table revealed that most of the risk reduction techniques could be consolidated into more general characteristics, and that the most important risks for project failure would be addressed. The author chose the arbitrary number of ten characteristics of projects that were reported to improve the process of EPR project implementation.

7. The author compared the ideal implementation plan to what actually occurred during the course of the EPR project in Chile. The author used original project documents that were generated from committee meetings, work sessions and interviews and data collected by observation to identify where the EPR project had incorporated recommended process steps into the implementation plan and where it had not incorporated the techniques.
8. Finally, the author evaluated the impact that using risk reduction techniques in the implementation plan had had on the project implementation process.

CHAPTER 4: RESULTS

The implementation process that was followed during the EPR project in Chile is compared to the implementation process that was recommended in Chapter One. The introductory paragraph of each section recalls the major points of the findings in the literature and is highlighted with the use of *italics.*

The table below shows the features of the two medical centers that were chosen for the pilot project:

Table 1: General features of the pilot clinics

	Exam Rooms	No. of Doctors	No. of nurses	No. of other medical professionals	No. of receptionists	No of patients
1	34	91	9	6	19	61,694
2	20	32	3	3	2	15,138

A. Vision

The most important feature that the implementation plan must have is a stable, concrete and documented vision of the future of the organization and the role that the product of the project has in that vision. The EPR should be aligned with the organization's vision and it should be included in the vision so that the users see the EPR is a priority for the organization's future. One must be careful not to generate exaggerated expectations about the EPR project in the minds of the users when communicating the vision for the organization. Stick to the facts about the project and its scope.

The Vision that the organization held at the time of the project was to "Give the patient the power to control his or her health, thereby maximizing their quality of life over their lifetime". This was approved at the highest levels of the organization. The organization's belief that the patient should have the ability to control their own health led to their commitment to provide the medical resources, medical services and the information necessary to meet that vision for each patient.

The vision for the project included the modernization of the organization's care strategies and management. The organization wanted to reinforce their medical care processes by computerizing the care network with software applications that could guarantee an improvement in the quality of care by using integrated, consistent and trustworthy information. This vision translated into the objectives for the project: to improve the quality of care, to improve administrative and clinical processes, and to improve the quality of information available to the organization's staff.

The vision of the project, and its support by senior management, was certainly aligned with the literature's recommendations for this important element of the EPR project. The project took on the role of integrating all of the disparate information systems into one seamless user environment. Clinical data had been maintained in paper-based records prior to the implementation of the EPR project. The EPR focused on the clinical information about the patient, but

gave the staff easy access to administrative, financial and other data through interfaces with other systems in existence in the organization.

The project team was very careful not to generate unrealistic expectations about the capabilities of the system or how the organization would perform after the processes had been reengineered. Once the initial goals of the project were established, the project was presented to the CEO of the organization. With his approval, the project team proceeded to communicate the project to the "leaders of change" or the physicians and nurses that were considered most influential in the organization with a special emphasis on communicating the project to personnel from the medical centers that would implement the system first.

B. Leadership

The leadership must be aware of the vision of the organization at all times, and it must be able to communicate the vision to the decision makers at all levels so that all participants are working towards precisely the same goal. There must be physician leadership to help convince physicians of the utility of the project and to ensure that in the development stage, physicians' concerns are taken into consideration to reduce physician resistance to the project and enhance their involvement at the analysis stage. A second form of leadership that should be present in the project is technical and management leadership that can make realistic decisions about the project from the standpoint of technology and resource allocation.

The project had very committed leadership. First, the project had the support of the CEO and the General Director of Health, who reported directly to the CEO. The General Director participated in the early planning of the scope of the project, ensuring that it aligned with the vision and goals of the organization. This director also participated in the biweekly steering committee meetings that were held with the project directors and the project managers from the consulting team and the organization. The leadership of the project was assigned to the project manager from the external consulting team. She had expertise in systems analysis and process reengineering. Her biggest role was maintaining the communication between the various members of the project team that grew considerably in size over the course of the project.

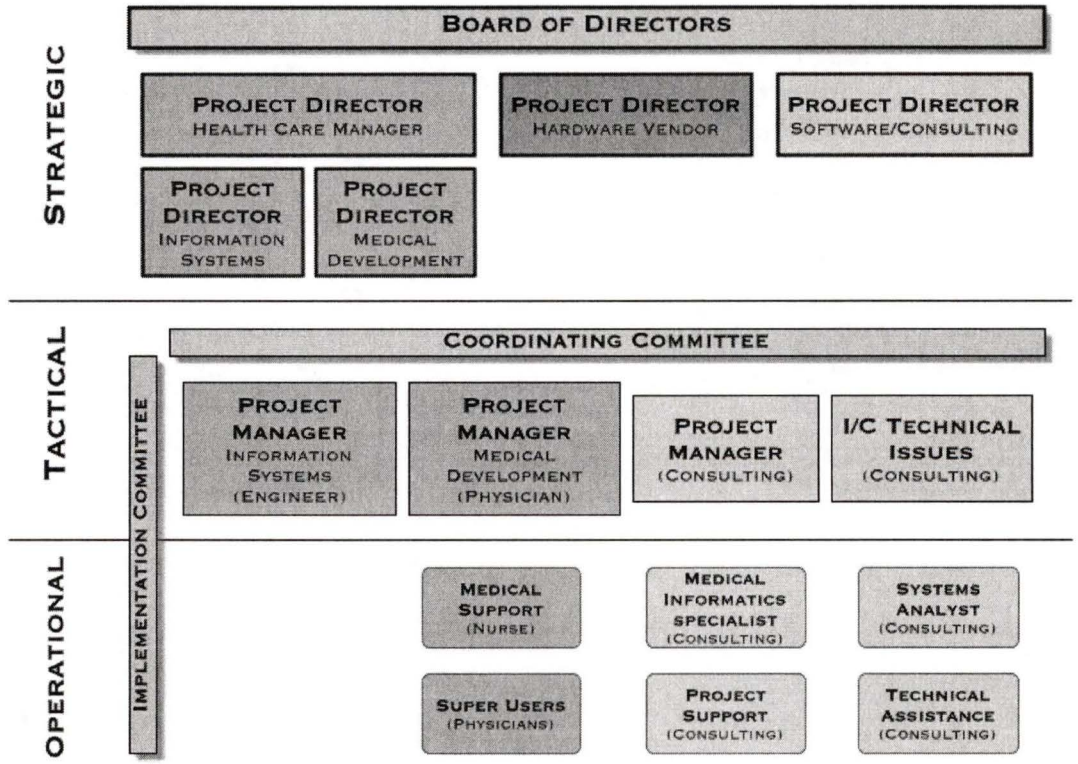
One of the project managers on the institution side was a physician who had an interest in medical informatics and who had the respect of his peers within the organization. He assisted the project team with communicating the value and goals of the project to his fellow physicians. This physician was also invaluable in providing clinical input while evaluating and testing the EPR product in its various versions. The literature recommended the presence of such a medical professional and this project had one.

The CIO of the organization made himself available to the project at any time, and his suggestions and concerns were important from a technical standpoint. The project also counted on a health information scientist who was trained in liaising between computer scientists and the medical staff. This

leadership, culled from personnel with diverse expertise, was a great help in continuously covering the many requirements of the project without the need to rely on outside resources very often.

The leadership structure of the project easily met the recommendations of the literature because it was drawn from several different quarters. No one person was expected to take the lead in all aspects of the project, because of the varying nature of the expertise required. Open communication amongst the members of the project team ensured that the appropriate person was chosen to meet the project's changing leadership requirements.

Figure 2: The Organization of the Project



C. Communication

Communication at all levels must be unimpeded, complete, candid and relevant. The organization's vision and the project's objectives must be effectively communicated to all participants, as well as the decisions that are made during the course of the project, and the progress that is being made.

In general, the communication at all levels in the project was very open and effective. There were several members of the project team that had excellent social skills that made the integration between the client and the consulting team seamless. This was very important because the project goals were adopted by all parties and it significantly reduced the tendency to "blame the other side" for problems in the project implementation. The team adopted the attitude that the success of the project was important for both the consulting team and for the organization and the project team worked together towards the timely resolution of any difficulties that arose.

There were some problems during the project, particularly related to the timeline and the scope of the pilot project. These concerns over the life of the project were dealt with by open communication and consensus about the decisions reached. The steering committee met frequently and was very helpful in making decisions, and especially resource allocation decisions, that were beyond the scope of the project team. The cooperation among the project team members was noteworthy as well, for it led to daily progress meetings and open communication about problems as they arose.

Communication about the project to the organization's staff was also effective. The project gave several pre-training presentations about the project to medical staff in the medical centers where the pilot project took place. The medical directors of the two pilot medical centers participated formally in the steering committee meetings once implementations began, and that was a great help in disseminating information to each center's medical staff, and getting the concerns of the physicians in the medical centers back to the project team. One medical director in particular, took an active role by having meetings, writing letters and distributing tip sheets to keep his professional staff informed and content. His leadership, related to the project, but not directly involved on the project team, was instrumental in achieving a high level of acceptance and the cooperation of the physicians in his clinic.

Communication during the rollout phase was also a critical factor in the success of the project. There was always someone from the project team circulating amongst the staff to determine how people were faring with the EPR. Once the rollout began in each center there were daily meetings in the afternoon to see where successes and failures had occurred during the day. The meetings included members of the consulting team, the project managers from the client, the medical director, the head nurse, the administrative head and the super users. Often the Director of Medical Development would also participate in this daily meeting to have a front line view of the progress of the project. The goal of each meeting was to assign someone the responsibility for resolving any problem

that arose, and to ensure that a resolution date was given. This approach ensured that each problem was addressed in the minimum time possible. Problems that were received by the help desk were also reported during this meeting. The daily usage levels of the application were also presented and monitored during these meetings.

The organization also communicated a strong commitment to the success of the project. For example, while the administrative staff was being trained in the use of the application, staff from the organization's temp pool replaced them at the reception areas. That sent a very important message about the value the organization was placing on the training of their receptionists and nurses.

D. Planning

The project implementation plan is developed in stages. The plan consists of a project scope document, a work plan that is laid out in sufficient detail that the project team understands what is expected of them, and documents related to changes tracking. The key to successful control of a project is communication and the work plan assists with the communication about the true status of the project. The project timeline is generated once the requirements have been defined for the project. The project team uses the work plan to monitor and report on the progress that is being made.

The project team planned the project meticulously. Consensus was reached by the team (including the client) and then forwarded to the software firm to ensure that project goals and proposed changes to the application could

be met in the time allotted. The project plan was published and available to all parties in the project. At the biweekly steering committee meetings, the project manager presented the objectives that were supposed to have been met during the previous two weeks, the degree of completion, and the major objectives for the following two weeks. This ensured that the status of the project was always very transparent, and corrective action was taken immediately in the case of a schedule slip.

There were slips during the course of the project, particularly with respect to the timing of the first center's go-live date. The project had generated a lot of anticipation in the minds of that centers' physicians because the project team was located in the same building as the medical center, and several physicians from that center were participating in the configuration of the application. When the project was delayed due to the late arrival of the software, it did create credibility problems as the literature suggested. The project was pleased with the eagerness the physicians demonstrated with respect to commencing their training and using the EPR, but recognized the danger of the mounting frustration due to project delays.

One suggestion from the project management literature that was not incorporated into the project was a formal mechanism for changing the scope of the project. The client contended that the software had some limitations because it was lacking features that they had seen in competing products, and that created conflict towards the end of the pilot phase because it was never

established how to formally request changes to the software and to ensure that they were carried out. The consulting team made many changes on good faith, but that was not a sensible way to maintain the integrity of the project. One cannot always say yes to client change requests without jeopardizing the end date of the project. The team should have had a mechanism in place to analyze the consequences of the requested change and then reach a decision as to whether it would be done and to adjust the timeline accordingly.

E. Dealing with Physician Resistance

The project should seek out physicians' input about the clinical value and integrity of the EPR. Conduct a survey of physicians to determine their expectations and needs prior to the implementation. Demonstrate the personal benefits the EPR system can provide to the physicians at the earliest opportunity. Focus the organization on the patient and exhibit the attitude that the EPR implementation must take place in order to better meet the patients' needs. Compensate physicians. The rollout should take place in the clinic where the physician champions are located because they are more likely to accept the changes than other physicians.

The project team made a special effort to minimize the physician resistance to the Electronic Patient Record because the author was aware of the suggestions in the literature, and was concerned about the potential that physician resistance had for causing an EPR project to fail. The importance of physician acceptance and use of the EPR cannot be overstated. Management may

desire the information that an EPR can provide so that they can use it to make better decisions about products or services that will be offered, but if the clinical data is not entered into the database, there will be nothing to analyze.

The project took several steps in order to respond to the physicians' needs. They incorporated a physician from the organization on the project team. They established a group of "leaders of change" that was made up of several physicians from the organization and more importantly, included acknowledged skeptics about the whole process. Their role was to learn the application and to contribute their suggestions to improve the product and to help to configure the EPR for each specialty. The group helped to decide which medical coding systems would be used, they helped to develop the medical guidelines for their specialties, they generated the minimum clinical data set that would be entered as the patient history, and they developed Chilean synonyms for the medical codes so that the application was adapted to the physicians' common disease vocabulary. Prior to the implementation, the author also administered a survey (See Appendix 2) to determine the specific concerns of the individual physicians that were about to undergo the process so that they could be addressed during the implementation.

The author's role in the project took place after the EPR product had been selected, but the organization went through a lengthy selection process that many of the organizations' physicians had participated in. The physicians did not universally prefer the software product that was chosen. The physician

project manager preferred a competing product and that created an interesting dynamic as he strove to have features of his favored EPR included in the EPR that had been chosen by the organization. The physicians had a sense of ownership of the decision about which EPR would be implemented because the management did not impose it upon them.

The physicians fell into different groups as the literature suggested they would. They were not a homogenous group at all. There were different medical specialists, there were different ages represented, there were rural physicians and city dwellers, and there were differing levels of exposure to computer technology. The project catered to all these different individuals by being flexible in the software product and flexible in the response to training and support needs. The project tried to give incentives such as active participation in the planning phase and in generating clinical guidelines to the most enthusiastic physicians, and made up contingency plans in case there were physicians who refused to use the application. There were no cases of a physician that refused to use the EPR in the two clinics that took part in the pilot phase.

The organization always paid the physicians who participated in the project for their time and provided amenities such as lunch, dinner or snacks during meetings and classes to make the process as enjoyable as possible for them.

The physician champions for the project were drawn from the ranks of the two centers; therefore they were present for the rollout and user training and they supported their peers who hadn't had as much exposure to the application.

F. The Project Team

A multi-disciplinary team can help to ensure flexibility because different professions will view the importance of the EPR differently. The wider the relevant experience the team has to draw on, the more likely that creative solutions to problems will be suggested. A team that can communicate across professional and departmental boundaries is more likely to be able to create consensus about the project's progress and outcome.

The project team was flexible and multidisciplinary. The core team included an accountant, a physician, several IT specialists, a former nursing department head and a health informatics specialist. The team also drew on the expertise of the organization's legal department, human resources department and systems experts when their knowledge and experience was required. Physician specialists helped to define the clinical data that would be used in the application. There were no different departments per se in the organization. It was not a hospital, but a number of different medical clinics tied together by the same insurance plan and the uniform services offered. As that was the case, input from personnel in the different clinics was sought to incorporate their concerns and necessities as well.

G. Incorporating Information Technology

The project should only incorporate new information technology when it responds to the needs of the physicians and staff in the organization. The project must learn to weigh these factors when decisions about technology are being made.

In general, the project did not incorporate any "bleeding edge" technology at all. The application itself is programmed in a mature programming environment called PowerBuilder for Windows. The EPR has an object-oriented design that offers different views for different users. The major technological challenge was data replication amongst the centers and ensuring that the central database accurately reflected updates to the data, and yet still provided the speed necessary for a real-time application such as an Electronic Patient Record. The external consulting team provided most of the technical expertise but sometimes included personnel from the software provider and from the database company to ensure that the technological issues were resolved as quickly as possible.

Data integration *– Ensure that applications such as the laboratory information system or the radiology information system can communicate data between each other.*

HL7, a standard protocol for communication of health data between disparate applications, was not necessary for data integration because the existing systems integrated into the patient information system were not health information systems. One was an information system that the provider used to determine insurance coverage and benefits for the patient, and the other kept

track of the medical leave granted by the organizations' doctors. These two applications were integrated into the EPR by programming custom interfaces between the data sources.

Data mining – *In order to be able to easily analyze the patient data after it has been input, it is important to use standardized medical coding schemes such as ICD 10 for diagnosis, or LOINC for laboratory tests, within the EPR product. The data should also be divided into different fields in the data base so it can be indexed according to various criteria and improve the ability of the physicians to access useful information organized in the most appropriate way.*

The application incorporates coding schemes as well as free text entry by physicians. The physicians were encouraged during the pilot phase to use the coding schemes (or their synonyms) for diagnosis wherever possible. The physicians were reluctant to use the codes at first (ICD 9 CM) because they felt that the codes did not adequately reflect the medical concepts that they were trying to input; for example the anatomical location, or multiple diagnoses. The project worked around these limitations by mapping synonyms for common diagnoses in Chile to their standardized coding counterparts. This work was done according to specialty and reflected a localized version of the coding schemes. Because of the limitations of ICD 9 CM, there were some cases that were impossible to reflect, even with the synonyms (an example was a pregnant woman that presented for a pre-natal check up). For less common diagnoses, the

physician was provided a search tool to filter through the wording to find the correct code for the diagnosis.

The EPR includes other fields that are easily mined for data (besides obvious ones such as sex, birth date, geographic region, etc.) such as order entry, medications, allergies and motives for the patient visit. As the application matured, the possibilities coded for these fields included more and more concepts so that the physicians would rarely guess how a concept was labeled in order to include it in the patient record.

Unique patient identifier – *The method of identifying a patient in the EPR system must be such that no two patients receiving care from the institution could possibly have the same identifying characteristics.*

In Chile, every citizen is given a unique national identification number (like the Canadian Social Insurance Number) called the R.U.T. This number was used as the unique identifier for the patients of the organization. This created some problems because the child of a patient did not receive their R.U.T. until several days after birth. The organization decided to use the R.U.T. of the mother for the infant until their unique number was determined. While technically not correct, in practice, it worked quite well. Another problem with using the R.U.T. as an identifier was that the institution sometimes had foreigners as patients and the R.U.T was not applicable to them.

The organization's legal department studied the ethical and legal issues of using the R.U.T. (for example the ability to connect data between different,

unrelated databases) and it was determined that there were no legal ramifications for doing so in Chile. The project went ahead and used the R.U.T. while being aware of the potential for abuse.

Data security, confidentiality and privacy *- The organization must limit physical as well as electronic access to the EPR. It is necessary to create contingency plans that go into effect when a system failure occurs. Draft a policy that deals with the use of the data once it has been recorded in the organization's database.*

This issue was not satisfactorily resolved. The application offered security in the form of password protection and the clinics restricted physical access with security guards and generally restricted the care areas behind the reception areas. The application provided access to different features depending on whether the user was a physician, a nurse, a receptionist or a cashier. One area that was overlooked (and maybe impossible to resolve) is that the systems (IT) personnel (for example the project team and the database manager) had complete access to the raw clinical data in the database. The hardware that was located in the examining and treatment rooms was for the most part desktop machines with bulky CRT monitors. There were two instances of laptops in examining rooms because there was not enough physical space in the room to incorporate all the equipment. The physicians in those rooms were responsible for locking up the laptops at the end of the night. Physicians had open access to the EPR, from the appointment-scheduling module to other physicians' charting entries. The only case where that was not true was when a physician deliberately

marked his entry as private. The psychiatrists used this feature extensively, but under most circumstances the other specialties refrained from denying the other physicians access to their entries.

It was suggested that the organization develop an organization-wide, transparent policy for proper data use as recommended by Treister (1998), but it wasn't in place during the pilot phase. The issue of how the data would be used to measure physician performance was never made explicit either, though clearly that was one of the management objectives for the use of the information. The organization was creating a very powerful tool for itself because besides being a health care provider, it was also a health care insurance company that provided insurance coverage to its patients. The potential existed for the insurance side of the company to identify which of their patients were the costliest (those that had "catastrophic" illnesses - a Chilean term) from their patient clinical database and then deny them insurance coverage. The organization denied that this would ever happen. Again, the potential for abuse existed and wasn't addressed. The organization has since been split into an insurance company and a healthcare provider so the chance for abuse has been diminished but care should be taken by the organization so that data is not used in an unethical manner.

To respond to possible system failures such as a frozen screen or a power failure the project drew up a contingency plan. The plan was taught during the training of the physicians and staff. The database was regularly backed up and the storage medium was kept offsite. There were also universal power supply

systems and building generators in the case of power failures. In the year that this project took place, reliable power was a real concern because there had been a severe drought in Chile, and Santiago was subject to rolling power blackouts that had been instituted to conserve power. The backup power grid for the computer systems was tested every day for several months and performed without fail.

Data integrity (data errors) – *The EPR can be implemented such that it constrains and eliminates data entry errors on the part of the user.*

The EPR product does data validity checking for fields such as the RUT and date of birth. The validity checks were included as features of the software, but there were also several automatic calculations in the chart to simplify the process for the physician (BMI, for example). The receptionists were encouraged to ask for the patient identification card when making and confirming appointments so that the correct spelling of the patient's name was input in the database. The database could not distinguish between a Lopez and a Lopes, both "correct" spellings in Spanish. If the receptionist input the same patient with different spellings, in effect, two patients could be created. This limitation had to be overcome with process adjustments, not just with modifications to the EPR product.

Legacy data – *A strategy must be developed to mine the old system for the needed data, reformat it and put it in the new system. The recommended approach is an*

incremental one that allows the coexistence of legacy systems with their legacy data while the new systems are brought online and proven to work.

The data collected prior to the EPR implementation was considered lost by the organization. There was no effort to type in the information from the legacy paper records because they were scattered throughout the organization (separate charts by clinic, by specialty or by floor) and notoriously illegible. The organization decided on a policy that the first doctor to see the patient with the EPR would be responsible for recovering and inputting important data from the paper chart, and for the collection of basic clinical history data. The official policy was to eliminate the use of the paper chart within a year of the implementation. That policy was not enforced during the pilot phase of the project.

Conversion strategy *– The recommended strategy for implementing new EPR systems is to do it in a phased rollout across the institution rather than suddenly switching systems, which is simpler for the developers but much harder on the users.*

The project team decided to use the phased rollout approach. First the appointment scheduling application was implemented, then a call center application was implemented so that the first center's patients could still make their appointments by telephone, then the computer equipment was placed in the examining rooms without the EPR installed (just Windows and basic applications) so that doctors would get familiar with having the computer in their rooms, and finally, the EPR with limited requirements for use was rolled out on individual floors of the clinic and in two different centers. This allowed

the project team to identify problems between phases of the implementation. It also created an unforeseen complication in the case of the clinical data that had been programmed into the application. In the first center the application was being rolled-out by specialty so the team of doctors that had been working on the data to be included by specialty had arranged their schedule according to the roll-out going on in Santiago. The rural center started right after the first floor of the clinic in Santiago with all of its specialties. This created a vacuum of information for the specialists in the rural community until the Santiago group came on-line. It also served to frustrate the rural specialists considerably and, surprisingly, they created their own data sets and sent them to Santiago for input into the central information system.

Another challenge that starting up in geographically separate medical centers created was that the information in the localized application had to be synchronized with the data sets available in Santiago. This basic clinical data replication had not been fully considered as part of the replication process in the technology plan.

After the rollout of the basic functionality of the EPR in the two clinics, the physicians were expected to use more and more of the application's functionality. The medical director of the rural medical center personally audited his staff's performance inside the application since he had access to the charts. Further training was held several weeks later to reinforce the advanced functionality of the EPR for those physicians that needed it.

H. Effective Training

Training should be done as close to the go-live date as possible so that the user's retention of what has been taught is high. The training should be designed to be as responsive as possible to individual schedules and differing needs for instruction and support. A number of strategies can be used such as formal instruction, videos, computer-based training, and newsletters. The final stage of training is user support during the roll out.

The first step that was taken in this project was a survey of all the physicians to determine their comfort and experience with computer systems. The project quickly realized that there was every level of experience, from physicians that pointed the mouse at the monitor like a TV remote control, to physicians that were aware of such concepts as coding schemes and networking terminology. This created a real need to be flexible, both on the part of the physicians and on the part of the training team. The training was designed around hands-on examples during the lectures and there was a laboratory with several machines for the physicians to practice with outside of class hours. The training took place over ten hours, and the classes were offered several times a day with the same class being offered on any given day (all Mondays were the same). This allowed the physicians to make up missed classes in the following weeks. The physicians were asked to sign up for the classes the week before, and the head nurse did that person by person. This was a very effective method to

get the physicians motivated and to reduce the chance of them saying that they had "not being informed" about the upcoming changes.

The first center was able to divide the classes by specialty, and that was a great help in being able to target the specific needs of the individual groups. The discovery was that the specialists had very different information needs and the ability to focus on the functionality of the application that was most relevant to a particular group was very well received. By contrast, in the second center, the groups were all mixed according to the time the classes were given. This resulted in classes that were more frustrating for the participants. The hours that the classes were given were usually far outside of normal working hours (for example 6:30 - 8:30 AM or 8:00 - 10:00 PM) which created extra strain for the training teams, but was well received by the doctors who preferred not to take time out of their practices during the day.

The project team found that the time spent in user-support after the rollout was some of the most productive in terms of training. Physicians that hadn't really paid much attention to the training process were suddenly sitting across from their patients with the computer in their office. The team was present as much as possible on the floors to help doctors between patients and sometimes even be present during a patient visit. The physicians and receptionists were given the project office's phone number and the help desk phone number so that there was always someone available quickly during office hours to provide a solution to the physician's problem. The project team did not

have any identifying hats or coats because the team was small, and the same people that had trained the physicians gave support to them.

I. Changing the Organization's Care Process

It is important to realize at the outset that psychological and sociological factors related to changes can be more difficult to deal with than the technological factors. By incorporating change management techniques, the team can gain a better understanding of the potential impact that redesigned care processes will have on the organization.

The organization chose the implementing of the EPR as an opportunity to completely redesign their care processes. The consulting team began the project with an extensive systems analysis and a redesign incorporating the new applications and new processes. The existing processes were analyzed and redesigned using the input of people from all levels and functions of the organization (IT, nurses, doctors, physiotherapists, dentists, receptionists, cashiers, human resources). Every clinic in Santiago (11 in total) was visited, as well as one rural clinic outside of Santiago to make sure that all the different nuances of different centers was captured in the final uniform process. The idea was that the patient could go into any clinic run by the organization and receive care in exactly the same way, no matter where she was in Chile. The management team, the client's project managers and other key personnel analyzed the proposed processes document before it was finally approved. The

implementation plan was only drawn up after it was agreed how the EPR would be incorporated into the organization's care processes.

The user manuals that were developed for the organization reflected this attention to the new processes. The left hand side of every page had a diagram and description of the steps in the care process and the right hand side showed the corresponding place in the application that the information could be found. These combination user manuals/ procedure guides were very useful as references to logically step through the applications' functions, and as a reminder for what to do at any stage of the patient's activity in the clinic. A great part of the training was devoted to the new procedures that streamlined the patients' flow through the clinic. The points of contact were reduced significantly, and each point of contact was made much more efficient.

The physicians did not use a paper record that reflected the new EPR application prior to its implementation in this project. This was unfortunate because it would have helped them to see the way that data is input into the system and what information is required. One drawback to using this system would be that communication and perhaps training would be required for the physician to use this new chart effectively, and it would have to take place at a different time than the training on the computer system. On the other hand, it could reduce the training in the logical flow of the new system and make it all seem like less of a hurdle to jump.

One element that was not forgotten in the project's effort to change the process was the patient. The organization disseminated information to their clients about the upcoming EPR and asked them to be patient during the implementation itself. The patients' reaction to the EPR was considered a very important measure of the success of the project.

J. The Impact of the EPR

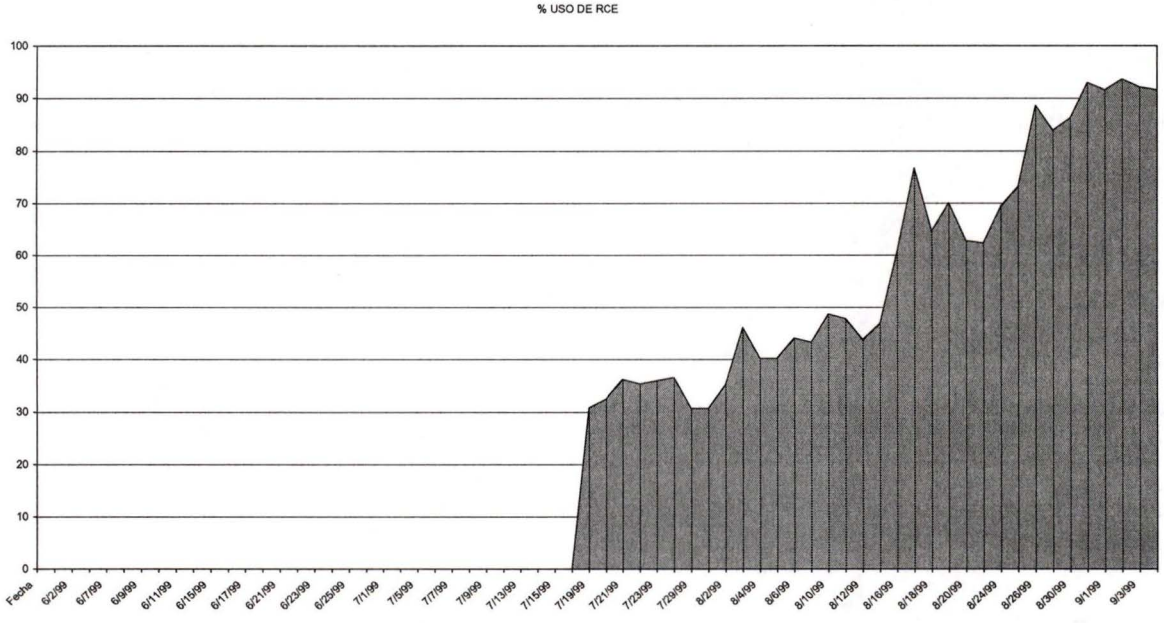
It is important to gather data related to system performance during the implementation and maturation phase of the project. The reason for demonstrating the improvements attributable to the EPR at the earliest opportunity is to justify the large start up costs of these projects.

As the literature suggested, measuring the impact of the EPR is one of the most difficult problems that the project faced. The continuation of the entire project hinged on how well the pilot project was received. Internally the project decided to measure the usage of the application as a measure of its adoption and success. The other method was to survey physicians, staff and patients to find out what their experience of the application was.

There was a daily usage measurement for the EPR according to its various groups of users by querying the database. The measurements were distributed daily to the users so that they knew where they stood with respect to previous days and with respect to their peers' averages. There was an active role taken by the nursing leader and medical directors of the medical centers to ensure that the

information was disseminated and that proper action was taken to correct any difficulties that were encountered by the staff as they began to implement the system. The measurements were crucial indicators of problems and the project members were able to zero in on difficulties using the usage reports as a base. The usage levels for the EPR application by physicians is in the diagram that follows. It can be seen that the usage levels increased over time and held steady at close to 100% once the physicians became accustomed to using the application.

Figure 3: The Use of the EPR Over Time (19 Jul 99 - 3 Sep 99)



The project team's finding that the pilot had been a success was borne out by an independent study commissioned by the CEO of the organization at the conclusion of the pilot project. In early 2000 the entire project was given the go ahead by the organization and the team began to draw up an implementation

plan for the entire organization. As this thesis is being written, the EPR has been implemented in the eleven medical centers in Santiago, and the system is integrated with the call center. Implementation continues in the final rural centers and is due to be finished by the end of 2001.

K. Important Process Improvements in the Chile Project

There were several features in this Chilean EPR project that made it unique compared to those reported in the literature. The first is that it took place in a multi-cultural context. The consulting team included an Argentinean, a Canadian, a Colombian, a Uruguayan and various Chileans as well as the presence of Spaniards from the software company from time to time. This added a level of complexity to the project because of language barriers and cultural differences (even amongst the various Spanish speakers). It was a challenge to create understanding amongst the various cultures in the project.

The team worked to overcome cultural and organizational differences. The first step was to recognize that cultural differences existed. Later, the team worked towards reducing the negative impacts and improving the positive ones by making an effort to get together outside of the workplace and share on a more personal level. Typical examples were lunches, sightseeing trips, birthday dinners and dancing. These get-togethers helped form a greater trust amongst the team members and created several less formal opportunities to lodge complaints or channel concerns. These opportunities for sharing also increased

the cohesiveness of the team and made the implementation experience more positive for all concerned. A special mention should be given to the generosity of the Chileans and their desire to share their culture and traditions with the foreign members of the team. It has created bonds that have extended beyond the life of the project.

The different backgrounds of the team members generated creative solutions to institutional inefficiencies because the team's expertise was drawn from different national health care systems and ways of doing things. The organization assigned one office to each physician, for example, and the patients rotate through. In Canada, this would be considered an inefficient use of the physician's time because they have to wait while the patient undresses or is attended by the nurse. Normally a Canadian physician has two or three examining rooms and the patient is the one that waits for the physician once they are ready to be seen.

A great motivator for the Chilean client team was the participation of implementation teams from Argentinean health care organizations in the Chilean project. The knowledge transfer from the consulting firm's other clients in similar projects to the project team in Chile helped them to anticipate problems, and see that the project could have a successful outcome. The client team members in the Chilean project also had the opportunity to visit other projects to see what the software tool looked like when it was fully operational. The Chilean client was reassured by communicating directly with fellow-physicians that had

experienced the implementation in other projects using the same software. The consulting firm also created incentives for physicians from other projects because it portrayed them as experts in the process, and as leaders in their respective institutions.

In terms of technology, the literature does not refer to the convenience or location of computer equipment and printers. In this project, it was decided that the computer terminals would be placed in each examining room and several in each reception area to make and confirm appointments. This was an adequate solution because it closely reflected the paper-based process. In the case of the printers, however, the process had to be changed completely because the organization decided to place printers in the receptions in the interest of initial equipment cost and maintenance costs (an inkjet printer may seem economical at first, but the ink costs can make its long term cost much higher per page than a fast laser printer). All printouts that the physician made (prescriptions, handouts, a copy of the chart) had to be retrieved from the reception area or delivered to the physician by the receptionists. With recent hardware developments since this project, the possibility for an organization-wide wireless implementation should simplify data entry for physicians. Notebooks could be given to every physician so that they can access the network from wherever they are in the institution. The major hurdle to overcome in this case is the security of the laptop computers in an open environment such as a hospital or clinic.

In this project, the implementation of the computer system required significant reworking of the roles and responsibilities of employees. The new system required more technical personnel than the system it was replacing. An implementation team should expect to calm the fears of personnel that assume their jobs are at risk because of the introduction of computer technology. It is useful to address this issue directly with the Human Resource department so that a strategy for dealing with the question can be drawn up. It was found that the fear or rumor of redundancy amongst the staff had a negative impact on their morale. The project team must be prepared to give clear facts about what measures are being taken to protect staff in the transition, or how the vision of the future will include current staff members. For example, the team could assure everyone that they will receive the training necessary to use the new system and that will provide some security for the personnel affected.

There were several factors that led to an easier adoption of the EPR in this project than what was documented in the literature. First, the organization was a private health care organization. The physicians were, in effect, employees of the organization. They were paid a fixed amount per patient, and the patient visits were uniformly allotted (usually one patient every 15 minutes). This gave the organization great leverage in insisting that the physicians use the application because there was an implied threat that the physician could be "fired" for failing to comply. In the case of the first two centers, this was never an issue, and most physicians seemed enthusiastic and eager to try the EPR. The second factor

that may have played a role in the project was the perception among many Chilean physicians that the EPR was widely used in the US and Canada (partly because of the presence of the author on the project team) and therefore, that they were "behind" in the latest clinical technology. The organization was also the first in Chile to implement an EPR. This motivated the physicians to learn the application and be on what was perceived to be the cutting edge of the medical profession.

CHAPTER 5: DISCUSSION

This study used the continuous risk management (CRM) paradigm as a process to follow to reduce the chance of project failure. The CRM paradigm calls for the identification of risks, their analysis, planning a response, tracking the success of the response, controlling the response and communicating about the process at every stage with all participants in the project. The author found that using the medical informatics literature to identify potential risks to an EPR project and then to plan the project team's response to them followed the identification and planning stages defined by the Software Engineering Institute. Communication, which underlies the continuous risk management paradigm, was also reported in the literature to be one of the keys to project success.

The literature search provided valuable information about problems that had occurred in prior projects, and any problem that was given attention in the literature was considered a potential risk in the EPR project. Normally, the problems described in the literature were also accompanied by recommendations for how to resolve them. The use of the literature assisted the project team to anticipate risks and communicate them to the entire team. The literature also served as a guide for the team's responses to the problems. The combination of these two aspects allowed the team to anticipate, understand and make decisions about risks earlier than would have been possible without using the literature.

The literature certainly did not cover all of the unique circumstances of the Chilean project. As a guide for future projects, the author reported this project's responses to the unique circumstances that were not reported in the literature but that may occur in future EPR projects. The use of the CRM paradigm to look critically at the literature as an aid in identifying risks and planning responses to them did improve the process of project implementation. Most of the risks reported in the literature affected the Chilean project, but using the literature allowed the project to anticipate risks before they became problems, and the project was implemented successfully.

The author grouped the responses to potential risks into ten characteristics of a successful project as reported in the literature. These characteristics were Vision, Leadership, Communication, Effective Planning, A response to Physician Resistance, an effective project team, an understanding of the technological issues, effective training, understanding how the project would change the core processes of the organization, and an effective measure of the impact of the EPR. In analyzing the project documents, it was found that the project had successfully incorporated every characteristic of a successful EPR project in the implementation process. The evaluation of the project against requirements criteria, usage measures, and the satisfaction of the users and patients found that it had been successful. A second evaluation was conducted by an external review that was not available to the author, and its findings were consistent with the organization's internal evaluation, and the decision was made to continue the

implementation in the rest of the organizations' medical centers. This decision and the satisfactory process of the EPR implementation leads to the conclusion that heeding the risk reduction recommendations reported in the literature did improve the implementation process of the EPR project in Chile.

The author found that the characteristics of vision, leadership and communication were the most important risk management techniques. The presence of these three factors meant that the project team was able to draw on the experience and wisdom of the leadership when there were problems within the project team itself. The organization's vision was drawn up and supported by the directors of the project and the EPR was very clearly a part of that vision. This meant that the project wasn't a trial run and the organization was committed to finding a way to make the project successful. Communication was very important in this circumstance because when problems moved beyond the scope of the immediate project team, they could be addressed at the appropriate levels of the organization. It was clear that communication allowed the problems to be transparent, and because they were transparent, they were resolved more quickly than if they had been allowed to remain hidden.

The way that a software product should be chosen is not given careful consideration in the literature. In the case of this project, the clients' understanding of the scope of the software was not accurate. This may have been a result of not having adequate demonstrations of the product, inaccurate descriptions of the product specifications, or simply promises that the software

would function a certain way, and when it arrived, it had different behavior or did not function at all. This confusion about software specifications led to the greatest conflict between the software company, the consulting firm's implementation team, and the client's implementation team. The confusion about software capabilities had a negative impact on the implementation process. The author suggests the following guidelines to avoid problems related to the software requirements definitions in the future:

- The consulting/software team should never oversell the capabilities of the product to the client in the marketing phase of the project. There is a temptation to make the software appear to have greater functionality than it does, in the hope that it improves the product's chance of being sold (with the thought that the promised functionality can be added over the course of the project). When the client discovers that the product doesn't have the functionality that is claimed, or that there will be a delay while that functionality is programmed in, the trust is broken. This happened several times during the course of the project and led to serious rifts between consultants and the client team that had to be overcome.
- The client should demand to see live demonstrations of the functions that the implementation/software team claims are included in the product. A consulting team can hide behind a demonstration of the products' capabilities using screen shots or a video, for example, instead of letting the client get a hands-on experience. This buys the implementation team

time to actually program the functionality into the product, but it doesn't give the client the transparent understanding of the state of the product that they need in order to make effective decisions. If the implementation team refuses to give a live demonstration, or delays the demonstration, it can be safely assumed that the product does not have the functionality claimed.

- If the client understands that a given functionality will be programmed into the product, a clear software-testing plan should be drawn up so that the responsibilities for testing are understood by all parties. The software team often sent a "completed version" to the project in time for the implementation deadline specified in the work plan, but the version hadn't been thoroughly tested, so there were problems that made it impossible to implement anyway. That was a frustrating experience for the client, and again, it negatively impacted the trust built between the teams. This could have been avoided by specifying who had the responsibility for testing at the outset, and including it in the project's work plan.

It should be noted that this study was not conducted with a control group. The results in the literature were generally supported by their experiences. This thesis follows this trend, with a more comprehensive view of past implementations than other studies, and the findings are consistent with the experiences that are written up in the literature. The evidence for what makes a

successful project will be cumulative as more projects report on the decisions and responses that were successful, and those that were not.

The author found that participating in a commercial project was frustrating from an academic point of view because, while there may have been objectively correct responses to the problems that were encountered during the course of the project, there were times that the author was not able to implement them for political reasons (an example was assuring the client that the software had a certain functionality and knowing that it did not implement it completely). Sometimes the reality of the project will dictate a response to the problem that is different from that reported in the literature. The leadership must be flexible and adapt to the reality of the project's particular circumstances.

Another problem in looking at the outcome of EPR projects is that they are very difficult to evaluate in the short term. In this project, the client decided that the project was a success, and in large measure, that is what determined that it was a success. Measurements such as the software's compliance with requirements, or the number of physicians using the application, or user satisfaction can be used as they were here, but there are still no conclusive measures to take and show the client that the project was a success. For example, an analysis of the Return On Investment is not useful unless you know the costs involved in using the original system, which is most likely an unknown for most organizations. Instead, the success of this project will be measured over the long term by measuring the quality of the information that the system provides, by

the appropriateness of care decisions that are made based on clinical information, and by the cost reductions that the organization can achieve by using guidelines that are appropriate for a Chilean private healthcare organization. The outcome of this pilot project was hardly conclusive after 6 months of use when the organization decided to go ahead with it. The decision was largely made on instinct, but using these risk management techniques helped ensure that that decision was favorable to the project team.

CHAPTER 6: CONCLUSION

EPR project teams will find that following the continuous risk management paradigm to identify risks and plan responses to them will improve the process of an EPR project implementation. The literature contains many insightful articles that demonstrate the risks that were faced by various projects and this information can be used to identify the potential risks in any EPR project. The summary characteristics of successful EPR projects outlined in this thesis can serve as a base for planning the project team's response to potential problems. It may be useful for future projects to return to the literature to verify that there are no new responses being recommended or responses that apply to specific circumstances but that didn't apply to the Chilean project (e.g. new information technology that requires extraordinary consideration). The unique characteristics of the Chilean project that are described in the results section are presented to show how projects can face challenges such as a multi-cultural team or a product designed for a different national health care system that are not covered in the literature and perhaps give specific guidance for future projects that exhibit similar characteristics.

Future Work

This section is derived from Table 1 in "Toward an Informatics Research Agenda" (Kaplan, Brennan, Dowling, Friedman and Peel, 2001, p. 236).

Many gaps in current healthcare informatics knowledge that need to be addressed in future studies were identified in the course of this thesis. The Electronic Patient Record is still a very new technology, and it is understandable that the knowledge surrounding its use and implementation is not mature yet. The author suggests that the following topics are the most pressing problems that need to be solved in order for EPR's to meet their promised potential:

1. *EPR project evaluation.* This is a very important point because it highlights that organizations do not know how to prove to themselves whether implementing the EPR was a good decision or not. This is dangerous for EPR projects because in the budget squeeze that healthcare systems face, if the project cannot demonstrate the system's value, it may be discontinued. One must remember that an EPR system may demonstrate its value in terms of accessible information, legible information and reduced duplication of orders. More study must be done to show conclusively whether the EPR really is a beneficial technology to implement and alleviate the need for each individual project to take on that responsibility.

2. *Privacy, security and confidentiality of patient data.* This is a grey area in most countries in Latin America. Information privacy laws are not made with

confidential electronic patient records in mind. They are either behind the technology, are unhelpfully limiting (i.e. paper records must be maintained for legal purposes), or do not include the full scope of the dangers of patient records. In some countries, such as the United States there are laws in place that govern the treatment of the patient data. The laws should be studied to ensure that they are adequate for new technologies and that the technologies that exist are, in fact, compliant. An example that shows how these policies may have to change over time, is that early data encryption schemes that took older, slower microprocessors a prohibitively long time to crack, can now be done in far less time with modern and extremely powerful microprocessors contained in typical personal computers. Information policy and procedures must be drawn up at the institutional level covering topics such as physical security measures so that the data is not compromised, and it would be helpful to have studies to show the success of these policies and procedures.

3. *What are the ways that work processes can be improved by using clinical information systems?* How can EPR's be changed to follow new processes? Since the thesis only covered the basic implementation of the EPR, it did not go very deeply into the impact that it would have in the future on care processes in the organization, or how the usage patterns of the physicians would be different from the traditional paper record and information gathering tools such as the telephone and drug references. This area of study will be fascinating because it will generate some of the information required in the first question above to

prove the worth of the record. Great anecdotal evidence for how the EPR will transform in the coming years is how the word processor has transformed into a grammar checking, spell checking, dictionary including, thesaurus bearing, total text formatting juggernaut in multiple languages. The EPR's evolution as a tool that can aid physicians in their care processes is indubitable and research should be done to identify characteristics, technologies and processes that should be incorporated as it evolves.

4. *How can the EPR be tailored for use by a wide variety of individuals in a wide variety of places or circumstances?* How customizable can it be, and who can customize it? This question follows on from the word processing example. The word processor can be customized to show interface elements that the individual user wants, it can correct the language that the user is using and correct it as the user types. Ideally the EPR should follow the customizability trend of other computer applications so that the application bends to the individual users' practices such as the ophthalmologist that wants access to radiology reports, not so that the user has to break down and conform to the way the application wants to be used (e.g. only radiologists will have access to radiology reports). A first step would be to customize the application at least to the level of different specialties. For example, an ophthalmologist normally requires access to different clinical information than a radiologist. This question also refers to how to make different parts of the application visible for different user profiles and allow or deny access to data based on specific profiles such as nurses,

administrative staff and receptionists. The application that was installed in the Chile project had to be modified by the system administrator and that is not the ideal way. Ideally, the organization would want to have each individual able to modify the application in the way that they choose, but within certain limits. The point of this question is to determine how far the limits of customizability should be within the organization.

5. *What effects does health care information pitched to an affluent health care environment have on populations with more basic needs and services?* The Chilean project highlighted that the clinical information provided by the software product that was originally designed for the Spanish public health care system transferred very well to an affluent private medical healthcare service provider. What is not clear is how the project might have worked in the Chilean public healthcare system that provided very basic services to the poor majority of the population that had no private coverage. The differing information needs could be studied, or conversely, if the public system is accustomed to little information, what would happen if the physicians in the system had much greater access to information?

6. *How does provision of health care information by foreign institutions affect local institutions?* In the Chilean project the original clinical guidelines developed for use in the application were translated and adapted from guidelines developed in the USA, Canada, New Zealand and England that were available on the Internet. Some of the guidelines such as one that called for expensive

laboratory testing that was prohibitively expensive in Chile were found to be useless in the Chilean context, some were found to be largely useful with adaptation, and some were found to be the same as the Chilean treatment practices. It would be useful to analyze how health care practices differ between nations and determine whether the differences are justified or if there is a "best" way to deal with the medical problems.

7. *How will clinicians and patients at an institution react to global indicators and guidelines?* How similar are the health needs across regions? Following on from the previous question, it would be useful to know how the physicians in the clinics across Chile were adapting to the organization's request to use the "officially-sanctioned" treatment scheme wherever possible. The strategy of the organization was to have an open feedback for the physicians so that any concerns they had would be directed back to the central office that controlled the guidelines in the application. It would be useful to know if there was information excess or lack depending on the region of the country. For example, were some areas of the country exposed to malaria and in need of a guideline for it, while other areas it was not considered necessary?

8. *How can data be integrated and aggregated across organizations to obtain indicators and guidelines for improving care?* The potential exists for differences between regions leading to different measures of the health indicators. The challenge for the organization is to interpret the data in a meaningful way. For example, do copper miners and their families in Chuquiquimata have different

health concerns than people who are exposed to the high pollution levels in Santiago? The nation-wide EPR for this organization will be able to provide this sort of detailed clinical information. It would be useful to know how the organization will react to the differences in their population if it exists. Will they offer different coverage that appeals to miners more than urban dwellers in Santiago? Or vice versa?

In conclusion, the thesis has shown that risk management techniques can be used in a normative model to improve the implementation process of an EPR project. This last section has also shown some interesting questions that arose during this research and some possible directions for future study that could help broaden the understanding of the impact of an EPR on health care and health care institutions.

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APPENDIX 1

A Chronology of the Project in Chile

June 6th, 1998

At the start they did not want the EMR to have its scope limited to ambulatory care in the clinics. The HMO wanted us to consider that it might be used in other contexts as well.

They wanted to look at the possibility to link the information resulting from medical services obtained outside the HMO's network to the Electronic Medical Record.

They wanted to be sure that the EMR was not limited to the services provided within the HMO's care network.

Within the care network, it was determined that the physicians would be responsible for filling out the Electronic Patient Record. For patient care received in clinics outside of the network, the information would have to be obtained from the reimbursement documents that are generated at the time of care.

This information was more appropriately obtained from an internal project, and not from the EMR. The information that would be obtained from these records would directly affect the internal application's data model.

To be determined: the legal and ethical impact of including the summary of external services in the Patient Record.

It was determined to have a meeting of "Leaders of Change" on July 17th and 18th. It was decided not to pay any compensation to the participants. It was determined that physicians that were interested in participating in the project after that initial meeting would be compensated.

Surveys to determine the level of computer knowledge and use of the physicians and staff were distributed. It was decided to have the data analysed before the meeting scheduled for July 17th and 18th.

June 17th, 1998

We met with those responsible for the individual projects under development in the HMO with the objective of understanding their scope. Interviews were conducted with both physicians and engineers that were in charge of the projects to get a broader picture of each project.

In many areas the internal projects overlap with the EMR project, and these possible linkages have to be explored in greater depth.

In some cases it will be necessary to make political decisions (for example whether the medical leave subsidy program can have access to the EMR or not).

The meeting with the CEO is scheduled for the 25th of June.

The following day there will be a presentation of the project to the other project directors and to the medical directors of the medical clinics in Santiago.

A preliminary presentation of the project was shown and it was decided that the phrase "physicians would participate in strategic decision-making" for

"physicians would participate in strategic decision making related to clinical matters.

Clinical Information Systems

The consulting director gave a lecture to the physician "Leaders of Change".

Objectives:

- Teach about information management and its application to clinical activity
- Present a clear and simple vision that permits the health care professional to participate in a Clinical Information System implementation.
- Give a definition about where we'd like to be with respect to information management at the operational and managerial level.
- Knowledge transfer in order to form "Leaders of Change"

Content:

- Information and health care concepts
- Computers in health care
- Health care institutions and their strategic information planning.
- The integration of business strategy with strategic objectives of Information Technology
- Definitions, standards and terminology
- Information system optimisation
- Integrating information systems

- Clinical information systems
- Computer networks and reengineering
- Emerging technologies

Teaching method lecture and dialogue supported by slide presentation. Use group exercises and activities to highlight the principles.

Meeting of the Change Leaders

This meeting will be held in order to begin the process of training the physicians in medical informatics.

The medical directors of the first three centres to be computerized in the first stage of the project must be included at the start of the change process so that they are committed to the project. The three ought to be included in the list of invitations to the informatics/Change Leaders meeting.

It was suggested that three Argentine physicians that were directly involved in other projects be invited to participate. It was accepted as a way to motivate the physicians of the Chilean healthcare organization.

It was asked that the medical director and the managing director of healthcare attend the meeting on Friday evening.

A pending item is the participation of a member of Human Resources.

Meeting with the "Change Leaders"

The project was presented at the meeting. It was similar to that presented to the CEO but the emphasis was on the participation and commitment of the attendees.

It was observed that the attitudes of the group members were not homogenous, but that it was a good group. There is a good understanding of the concepts of cost, but the understanding of quality is weaker. The concept of excellence presented difficulties. These themes were clearly presented to the participants.

In conclusion, it should be clarified that the participants were not taught all the basics necessary for them to be clear leaders of change. The activities that were completed during the weekend were focused on motivating the participants.

Some participant had doubts with respect to the use of computers because of a lack of informatics knowledge. The need to evaluate these people should be analyzed in order to motivate them.

Non-economic incentives should be identified for physicians.

Human Resources participated in the meeting and showed concern for the magnitude of change that the project implies. HR will develop a plan to disseminate information about the project, as was done with the internal call centre project.

Meetings held with the Change Leaders

Medical project manager will investigate the existence of a national drug list for Chile.

The Chilean Ministry of Health approved using the ICD 10 coding scheme. The scope of the use of ICD 10 has to be determined.

The impact of the electronic patient record on ethical and legal issues will be investigated. Of special concern is the aspects of privacy, confidentiality and security of the user data.

HR will give advice with respect to the design of the training program.

With respect to the issue of printers, the medical director thinks that a printer should be in each medical consulting room to print out prescriptions. The project leader will do a cost analysis of the option.

With respect to the issue of the recuperation of legacy data, the medical director thinks that the paper records should be archived for one year and only the new patients should be input into the system.

The project leader suggested analyzing the minimum data set that would be transferred from the paper record to the new electronic patient record.

The medical project leader is responsible for analyzing the data to determine the minimum set.

The need to have a psychiatrist in the group of Change Leaders in order to identify the minimum data set that they require was brought up.

Meeting August 6th, 1998

The medical project leader will prepare a presentation for the Change Leaders about Information policy and the policy for transferring the patient information from the paper record to the electronic database.

There will be direct communication with the physicians that make up the staff of the second centre to be computerized in the town outside of Santiago.

Meeting August 17th 1998

1. The nurse on the project delivered the results of the survey of physicians and staff. The objective of the survey was to understand and to evaluate the training needs of the personnel in the organization (both medical and administrative).
2. The IT director expressed the need to define new staff responsibilities and functions to ensure the success of systems at the go-live and into the future. Examples that he gave were an administrator of the Physicians' Schedules, and administrator for clinical guidelines, and an administrator for the approved drug list.
3. The Coding of Diagnosis - It was decided that coding would take place according to IDC 9 because in both the national and international field ICD 10 is not widely used and accepted. It was noted that there are applications that are partially restricted by their choice of ICD 10.
4. Ethical Legal Aspects of the Electronic Patient Record -the issue of confidentiality, privacy and security of data must still be addressed by the legal department. It was suggested that the firm should request an assessment given that it is unlikely that documentation or experience exists to use as a base. The director offered to initiate talks with the legal department to be taken up later by the medical project leader.
5. Recovery of Information - the Change Leaders are working to define:
    - The Basic Clinical Data Set

- The Basic Clinical Data Set for each specialty

6. These minimum data sets will serve as the base for work with the Electronic Patient Record. Input from the rest of the physicians in the health network will be requested. The data sets can also serve as a definition of the data the healthcare network would like to collect about its patients on their first contact with the system once it has been initiated. A strategy for this data capture must be defined. Two possibilities are:
   - The data is input by the first professional that the patient contacts. This means that extra time will be needed in the first appointment that the patient has with the health care network and represents an additional cost to the system.
   - The data is collected by a different person (for example administrative staff) that meets with the patient first to explain the new system and fills out a form that can be input later.
7. For the paediatric guidelines it was suggested that those used by CLAP (Latin American Centre for Paediatrics) could be used as a base.

October 5th, 1998

- A contingency plan for how to deal with professionals that refuse to use the electronic record must be developed.
- A help desk for the electronic patient record is being considered.
- The project expressed its desire to have a laboratory of ten machines for user training. The systems department will evaluate the proposal.

- A plan to inform the patients about the project is needed to minimize the negative impacts that a new computer system could generate.
- It is necessary to overcome resistance of the doctors to guarantee the success of the project.

October 19th 1998

- The work plan for the implementation of electronic patient record was presented.
- The model for the operation of client service was presented.
- The project's board of directors approved both.
- With respect to the personnel required:
    - The health care network assigned a physician full-time as a medical coordinator for the project.
    - The activities of the Change Leaders will continue for two hours weekly.
    - The coordinators for each specialty will meet with the Change Leaders. Other specialists will be incorporated as necessary. The total time required of each would be 4 hours.
    - The IT director suggested creating a Clinical Information Management project which defines management indicators that are products of the Computerization of the Medical Centres. He wants to load them into the database and then later exploit them using a data warehouse. This would permit the company to gain

experience using the electronic patient record and internally develop the rest of the statistical measures necessary for management in the future. He also requested a page long summary of the type of information that the electronic patient record to show the management indicators that could be generated.

November 30th 1998

Definitions:

- Diagnostic Guideline: a standardized way of capturing information
- Treatment guideline: Defines patient treatment depending on the motive for the visit, standardized by the health care organization.

The latest version of the application was shown to the project board of directors.

- The flow of a patient's visit
- Inputting relevant information: allergies, risk factors
- How to capture information from a visit using the specialist guidelines, checking or un-checking options, registering vaccinations, clinical measures, and treatment plan
- The input of diagnosis, marking it as a problem, and orientation or a revision.

Important Items:

- The input of medical leave (Chile has a national system for the granting of medical leave to employees), suggesting a new section in the patient

record that captures data such as number of days of leave, if there is a follow-up appointment or if rest is authorized.

- Include an option in the Clinical Management module that allows the crossing of data from the defined treatment guidelines and the actual treatment given to the patient. That is, they would like to determine those professionals that strictly adhere to the standardized guidelines of the organization, and those that don't.

Corporate decisions

1. The first medical centre that will be computerized is the largest and most important in Santiago. The go-live will be complete for the administrative functions of the application and incrementally for the clinical functions by floor. The patient reception areas will go-live on April 30th, 1999. The patient record will go-live the same day for physicians on the 5th floor, followed by the 3rd floor on May 31st, and the 4th and 6th floors on June 30.
2. The application will be activated in the call centre (for administrative functions) on the May 4th, 1999. This is in accordance with the requirement to have the call centre functioning before June.

A list of treatment guidelines to be developed by the specialists should be drawn up.

December 14th 1998

The definition of the minimum clinical data set, the patient history, and treatment guideline. Two alternatives for the input of the minimum clinical data set were developed:

1. A window for capturing the specific data.
2. Using the same structure as is used in the treatment guidelines.

The first alternative would require a much larger development effort to program each of the input windows and the changes to the data model underlying the application. The second alternative would permit the use of code that has already been requested for the input guidelines and the treatment guidelines. The software company determined that they would finish the programming of the guideline functions in January so that the software go-live date would stand as it is planned. Any improvements in functionality that will take more time than that will have to wait until after the go-live date.

December 21st 1998

Presented the Model for User Support in order to begin related activities.

- The model refers to support needed for the computer applications and systems.
- The medical director will be responsible for hiring personnel for support roles in the healthcare area (super users, clinical support).
- The director of IT will be responsible for hiring personnel for technical support roles (computer and network systems).

- The support personnel should be hired by January 15th, 1999 so that training can commence.

Important Items

The director of Human Resources suggested a plan for the dissemination of information about the project to physicians with the goal of establishing partners for the project. The plan includes presentations, informational brochures and documents to distribute. Two meetings with physicians have been planned for the large medical centre in Santiago with the goal of demonstrating the benefits of the project to them.

January 18th, 1999

Infrastructure for user training and application testing

A room with computer equipment is urgently needed in order to begin training and testing of the application.

March 1st, 1999

The health care organization is making the arrangements for the super users to work in the Computer Laboratory testing the applications with real data. During this time, they will be replaced in the receptions of their respective floors by temporary staff that will be hired by the organization. It will also be possible, with the addition of this temporary staff, to free the other receptionists for an hour a day to practice with the applications in the laboratory setting. Following this strategy, each of the floors will have user support for the go-live period.

As part of the training of the medical personnel, time in the laboratory should be considered mandatory. Also, training the medical staff over a two week time period to allow more flexibility for scheduling should be considered. On the other hand, it is time to profit from the investment in the group of physicians that were designated as Change Leaders by giving them roles, special training and the chance to participate in the different stages of the go-live period.

The Electronic Patient Record application will be presented before the project Board of Directors.

March 15th, 1999

1. Training:

- Training in the administrative application was given to the two groups of users that had not received training previously (10 hours per group).
- The medical directors of the clinics received 4 hours of training in the administrative application.
- User manuals were updated with missing information.

2. Change Leaders:

- A meeting was held with the Change Leaders to show them the administrative application.
- They have begun to test the Electronic Patient Record and are supporting the development of treatment guidelines.

- A new physician has been added to the group.
- A cardiologist that has participated in the installation of a similar system in the USA will be added to the group too.

April 12th, 1999

The training for physicians on the 5th floor will commence April 26th.

The work plan will be analysed and when the go-live date of [another in-house application integrated with the EPR] is known, a two-week period in the laboratory will be added to the timeline as additional training for the physicians.

A list of all the physicians and their schedules is being drawn up to determine the support needs during the go-live period.

April 26th, 1999

An electronic presentation is being developed that the physicians can study on their own. It includes the basic concepts of computer systems and Medical Informatics.

May 11th, 1999

Activities related to the EPR

- Training material is being developed: guide to operations (emphasis on the new processes of client service), user manuals (for the applications), presentations, the self study materials, and real cases that can be used in the laboratory to practice with the applications.

Activities related to the go-live

- Information sessions for the physicians on the other floors will be determined once the go-live date is established for them. The physicians of the 5th floor have already received the presentation.
- The computer systems will be placed in the examining rooms one to two weeks before the go-live so that physicians get used to having them there.
- Still determining the policy with respect to the printers in each examining room as well.
- They are revising the basic data required by the system.
- The definition of who will be the super users (medical staff) is still pending.

June 7th, 1999

Training in the EPR:

- Will commence on the 21st of June in order to coordinate all the activities, test the applications and finish the adjustments to the training materials.
- The computer equipment will be installed in the examining rooms on the 5th floor on the 16th of June.
- The information sessions for the physicians of the 3rd, 4th, and 6th floors will take place one week prior to the commencement of their training.
- The consulting group asks that the time between the end of training and the go-live for the physicians be no greater than 2 weeks.

June 21st, 1999

The training commenced with 3 groups of 9 doctors. The following week, the rest of the physicians (5th floor) will be trained. The training sessions in the laboratory settings are being planned and coordinated. The course instructors will inform the medical directors about which people:

- need reinforcement or training in the use of windows and the mouse
- are not willing to work with the system
- are willing to work with the system but require additional help.
- are willing and trained to use the system.

July 12th, 1999

Training complete.

The week of June 21st, 20 professionals were trained in 3 groups.

The week of June 30th, 10 professionals were trained in 2 groups.

Training in the laboratory commenced the week of July 8th. The nursing head is organizing the attendance of the physicians.

The week of July 26th, training will continue with the physicians of the 3rd floor.

The week of August 9th training will commence for the physicians of the 4th and 6th floors.

- The go-live date for physicians of the 5th floor has been set for July 19th.
- In order to help with the use of the EPR and give the doctors time to input the data required, initially every 4th appointment will be blocked.

- Those professionals that are incapable of inputting data into the system will use a paper form that contains the minimum clinical data set.
- The Clinic's medical director will inform the physicians the date that the system will be initiated and what is to be expected of them.
- The health care organization will find a facilitator who will listen to the physicians and communicate their problems to the project.
- The physicians will be surveyed for their opinions about the Electronic Patient Record before and after the implementation.

July 26th, 1999

1. The initial experience with the Electronic Patient Record on the fifth floor of the first Clinic.
    - July 19th the application was used for the first time on the fifth floor.
    - The initial information required from the physicians was to mark when the patient entered the examining room, the reason for the visit and a diagnosis. Despite that, there were physicians that completed the entire record.
    - 80% of the physicians used the application to record the patients that had been seen. Use was measured at the end of each day to see whether doctors had opened the patient record when they had seen the patient. The application records the time from when the patient record is opened for the visit to when it is closed. These states are

saved in the database with the patient information. By measuring the numbers of patients in each state, we could tell if the application had been used during the visit or not.

- Problems noted to date:
    i. physicians don't remember their login and password
    ii. Professionals who require training because they were unable to attend the classes. They will be signed up for the next series of courses (with the next floor's doctors).
    iii. The minimum clinical data sets are not completed yet for the doctors to use.
- The laboratory was made available from 13:00 to 15:00 (the typical noon break in Chile) but there was little participation.
- The general manager for the Health sector requested an evaluation of the performance of the professionals of the fifth floor with respect to the Electronic Patient Record in a document called the State of Advancement of the Project.
- It should be noted that the CIO and the General Manager of Health made appointments with physicians to evaluate in person how the application was being used in a clinical setting, and the performance of the redesigned work processes.

2. To keep physicians informed about the state of the project, a newsletter is being developed. It will include information such as a calendar listing the

delivery dates for basic Clinical Data Sets (by specialty), statistics about the use of the application, and a survey to capture the professionals' opinion about the application.

3. The legal department will be asked to find out the legal implications of using an electronic record so that the physicians can be informed.
4. The physicians that have laptops (due to space restrictions in their examining rooms) would like them to be changed to desktops because they are uncomfortable with them.
5. With respect to the basic data required by the application:
    - The diagnosis table is input and ready for use.
    - The missing "Reasons for the visit" would be input shortly.
    - A calendar of dates for the publication of the specialist minimum data sets will be defined so that physicians know when they can begin to use the aids that are available in the application. This item includes the Treatment Guidelines, diagnostic guidelines and Minimum Data Set by specialty.
6. The CIO would like to know if it is possible to start the application without exiting to windows.
7. Training for the second group of doctors began on July 26th.
    - The response of the physicians from that floor was excellent and all of the slots for the first training week are full.

- The sign up for the following week was started immediately to satisfy the demand for the course.

8. The physicians in the second clinic were surveyed for their opinion before hearing the presentation about the project. The responses will be processed during the week of the 26th and the results reported.
9. Problems reported:
    1. The health care organizations project leaders were not often present during the go-live period.
    2. All the specialties will be beginning in this clinic but so far the guidelines available in the system only pertain to internal medicine and paediatrics.
10. The newsletter will be distributed to physicians in the second clinic as well.

August 2, 1999

Electronic Patient Record first centre:

- The use of the medical record continues at 80% for the fifth floor.
- A survey will be administered to see what the doctors think.
- The newsletter would be sent to all the personnel in the first clinic.
- The training of the second floor of doctors is now complete.

August 9th, 1999

Electronic Patient Record First Clinic

- 46 professionals from the 3rd floor were trained.

- The week of August 9th would see the last group in the laboratory.
- The 16th of August the go-live for the third floor would begin.
- The 16th will also see the training of the final group of doctors from the 4th and 6th floors.
- Statistics are gathered daily about the use of the applications. The following morning, the head nurse on the project circulated with the sheet and showed each reception their performance with respect to the other receptions. This had the effect of quickly bringing the level of use up to 100%. One of the receptionists was designated as the super user and was instrumental in resolving immediate problems of the receptionists. She also made a trip to the second clinic to relate the experiences of the first clinic to them.

August 17th, 1999

Electronic Patient Record First Clinic

- August 16th the physicians on the 3rd floor started with the application.
- Training began for the final two floors.
- The General Manager suggested that the drug list only include the drugs that are approved for use by the health care organization.

Electronic Patient Record Second Clinic

- The report on the training of the professionals in the second clinic is attached.

- The medical directors of both clinics were included in the project committee meetings once the implementation process began in earnest in their clinics.
- The medical director of the clinic said that every physician in the second clinic had received training (and he had personally trained a few).
- August 10th was the go-live date for the physicians in the second centre (it is much smaller and was begun all at once). The first day the clinic achieved a usage level of 60% (a good measure compared to the first clinic's results).
- The physicians completed the requirements for the first week, which were to put in the reason for the visit, and the diagnosis.
- The diagnostic guidelines are not being used. It was explained that they were designed to aid with the data input and should not be obligatory. It was decided that the treatment guidelines could, in theory, be treated as obligatory.
- The medical director of the second clinic took a very active role in the project. The physicians in his clinic were well informed of the process and had his ear to make complaints. He was obviously a well-respected physician and had a very personable style that helped the persuasion of the value of the project. He went to classes to see the progress of the people in his clinic and he personally audited the patient records to see how the physicians were doing INSIDE the record.

August 23, 1999

Electronic Patient Record First Clinic

- The 3rd floor began the week of the 16th. There wasn't a huge impact as the majority of the physicians had actually started using the application the week previous.
- The usage statistics were reported.
- The training of the last 2 floors had been completed.
- The laboratory would be the following week according to the hours arranged individually with the physicians.
- August 26th is the go-live date for the final two floors.

Electronic Patient Record Second Clinic

- There was a meeting with the local clinical laboratory that the clinic used to see if there was a possibility of integrating the two information systems. (Sending/Receiving the lab test requests and Receiving/Sending the results).
- The medical director of the clinic sent out a letter to the physicians telling them how the first week went and letting them know the expectations for the following weeks.
- There were no problems reported.
- The specialists were complaining about the lack of Basic Data in the application that they could use (This happened primarily because the roll-out of the data was according to the specialties in the first, much larger,

clinic. The second clinic actually came on-line before the first in many specialties, creating a vacuum of data in drop down lists etc. for a few weeks).

- A calendar with the estimated dates of delivery for this data was to be drawn up. The database had to be replicated from the information in the first clinic, which was a technical issue.
- The medical director requested a course in Windows for his physicians. His opinion was that that was the major stumbling block in the use of the application. He also requested that games be installed on the machines so that physicians could get used to the mouse. The general manager said that no, it was not something to be done in the examining room. What was finally decided was that fictitious patients would be invented and placed on the database so that physicians could practice with the full functionality of the program.

September 8th, 1999

Electronic Patient Record First Clinic

- IP conflicts affected three different physicians. These problems will be resolved finally on September 26th.
- Based on the previous point, a contingency plan was developed using paper records. The physician would indicate on the bottom if someone else was authorized to enter the information into the system later. If the answer was yes, then the nursing staff would be responsible.

- Patients are being given an information sheet to explain the new changes that they are seeing in the management of clinical information. This is so that they are informed and understand the new system of care.
- August 27th the final two floors went live. The application usage is about 90%.
- The usage statistics for the EPR were reported. The general manager requested that all physicians that are not using the application be taken out of the statistic to stop the distortion. He also wanted to see a usage statistic by doctor to see who was not using the application.
- The problem of using the EPR for psychiatrists and psychologists was presented. The general manager responded that all of their information wasn't required by the health care organization for management purposes. He did want them to put in reason for the visit, diagnosis and treatment plan.

Electronic Patient Record Second Clinic

- August 24th the application was revised at the second clinic and a report of missing specialist data was written.
- The medical leader said that he would enter more data for the specialties that were represented in the second clinic.
- The statistics for use dropped in the second clinic and they wanted an explanation for why.

October 5th, 1999

The physicians that block two appointments to see one patient affect the usage statistic. One of the appointments looks to the system like the patient wasn't seen.

The medical director expressed doubts about the EPR's method of handling laboratory tests. The loop wasn't closed because the results weren't input. That was declared outside the scope of the EPR.

The CIO suggested creating a Medical Comptroller in each centre to monitor the usage of the EPR during the implementation phase of the system.

October 13th, 1999

The nursing director of the first clinic presented the usage statistics. She explained that the physicians that were below 100% were generally new and just starting with the application. There was one doctor that couldn't do it in the time allotted and another with health problems. The physicians would continue to be monitored and if it seemed like an attitude problem, the medical director of the first clinic would be informed and she would take action.

Working with the EPR

Approximately 80% of the physicians were entering the diagnosis as text. The application has provision for coding the diagnosis automatically, so the reasons for not using that feature were to be determined. The objective is to understand the difficulties that the physicians are having and take measure to help them.

October 18th, 1999

Strategy to reduce the number of diagnosis entered as text:

- The principle reason that physicians are not coding their diagnosis is that they want to express an additional characteristic of the disease (ie. anatomical position, initial pathology or in regression, the pathology is severe, moderate, or light). A second reason is it is difficult to input a compound diagnosis.
- To rectify the situation, a group of four medical leaders will meet to revise the synonyms, diagnosis and treatment guidelines, and the diagnosis available. Once this group has clarified and defined the application, they will train the rest of the physicians (by specialty) in its use.

October 25th, 1999

It was decided to convene a medical committee to specifically address the EPR and the information that it contains. Later this committee will regulate the implementation of the system in the rest of the centres of the health care organization.

October 28th, 1999

The Meeting of the Medical Committee

- The medical director of the project explained the work that the committee would undertake with respect to the clinical data and guideline development. He handed out a copy of the document that defines how guidelines would be defined.

- A letter would be sent to the physicians in the first clinic explaining the diagnosis that had been input and explaining to them that the diagnosis must be coded.

November 8, 1999

The medical director of the second clinic reported that the nursing director of his clinic had quit leaving a hole in terms of follow-up for the EPR and the administration of the doctors' schedules.

There will be additional training for the physicians of the second centre in the use of diagnostic and treatment guidelines.

November 24, 1999

The training in treatment and diagnostic guidelines was completed for all the physicians in the first clinic. A physician was contracted to consolidate the diagnosis and synonyms for diagnosis in the system. The doctors' major complaint is this point.

December 13th, 1999

- The training in guidelines was to be completed in the second clinic. There are some problems with coding and the guidelines have to be revised again. The physicians were made to understand the difference between the sphere of information in the application and the application itself.
- The project manager reports that there is a bad feeling among doctors for the lack of diagnosis representative of their specialty, long guidelines,

inadequate treatment guidelines, and information that hasn't been arrived at by consensus.

- The doctors that are developing the guidelines are concerned that they don't have access to the specialists for confirmation.
- The project manager stated that better communication was required to integrate all the physicians in the process and arrive at consensus. A representative from each specialty so that the physicians know where to turn to have their concerns addressed.
- The general manager requested better communication among the doctors so that they know what they are working towards and how to get there, especially as the guidelines develop and mature.
- One way of maintaining communications is have a binder for each specialty informing them of the guidelines in development and the advances in the application itself.
- Another problem was the amount of time it took to input the information for a new patient. The medical director would look at changing the policy to allow more time for the first visit.

December 28th, 1999

The binders are being prepared. January 3rd they would be ready. Each doctor would be given one outlining the information in the application relevant to his or her specialty, and any other information considered important. There was a concern about the logo to use because it wasn't certain whether the project

would be considered part of the Health Care Insurance Company, or the Health Care Service Provider.

APPENDIX 2

Survey for physicians (pre-implementation)

We are at the first stage of training in the use of the new information system, and very soon it will be installed in your examining rooms and in the medical receptions. We would appreciate knowing the perceptions and concerns that you have with respect to the subject. We would be very grateful if you could respond to the following survey.

We intend to follow up this survey with another one once the system is completely installed (in two more months) and present it again once you have acquired more experience with the information system (in approximately six more months).

1. Information about your experience

1.1 Age

__25-30 __31-35 __36-40 __41-50 __older than 50

1.2 How many years of experience do you have in the use of computers?

__over 10 years __between 5 and 10 yrs __3-4 yrs __1-2 yrs __less than one yr

1.3 How advanced would you consider your knowledge of the use of computers?

__very advanced __advanced __normal __limited __I have no knowledge

1.4 What is your speciality?

_____

1.5 How long does it currently take you to fill in the patient chart?

_____

2. Perceptions about the installation of a Clinical Information System

2.1 What expectations do you have with respect to the amount of time it will take to fill out the Electronic Patient Record?

__a lot less time __ less time __equal/don't know __more time __a lot more time

2.2 What expectation do you have with respect to the time used in direct patient care in the examining room once the new system is implemented?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.3 How do you think that the use of an electronic patient record will affect the relationship that you have with your patient?

__much better __ better __ equal/don't know __worse __much worse

Why?

_____

2.4 How do you expect the information system to impact the amount of administrative information that you receive about your patients?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.5 How do you expect the clinical information system to impact the amount of information that you receive about your schedule?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.6 How do you expect the clinical information system to impact the amount of clinical information that you receive about your patients?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.7 How do you expect the information system to impact the patient care in general?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.8 How do you think that the information system will impact the patient satisfaction that it receives from [the health care company]?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.9 How do you think that the clinical information system will impact your ability to do research about the health of your patients?

__much better __ better __ equal/don't know __worse __much worse

Why?

2.10 Do you foresee a specific problem that the installation of a clinical information system will cause?

2.11 Can you suggest a way that we can improve the installation of the clinical information system?

2.12 Is there some problem that currently exists that cannot be resolved with the clinical information system?

_____

_____

APPENDIX 3

The Results of the Physician Survey (pre-implementation)

					Question no.									
Survey No.	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
12	4	4	3	Cardiologist	3	3	2	2	2	2	2	2	2	2
6	4	5	4	Dermatologist	5	4	3	3	2	2	3	2	2	2
17	5	5	5	Gastro Intestinal Specialist	5	2	2	2	2	2	1	1	1	1
26	5	1	1	Gynaecologist	5	2	2	2	2	2	2	2	1	2
14	4	4	4	Gynaecologist	2	4	3	3	2	2	3	2	2	1
23	4	5	4	Gynaecologist	4	4	4	4	3	3	3	3	3	2
24	5	1	2	Laboratory Technician		2	2	3	2	2	1	2	2	2
11	4	4	3	GP	5	4	4	4	2	2	3	3	3	2
22	4	5	4	GP	5	4	4	3	1	1	1	1	1	1
4	3	5	4	GP	2	2	1	2	2	2	3	2	2	1
20	3	5	5	Nutritionist	3	3	2	1	1	0	1	1	1	0
15	4	4	2	Ophthalmologist	2	2	2	2	2	3	2	2	2	2
5	4	5	3	ENT	2	3	1	3	1	1	1	1	1	1
28	3	3	4	Paediatrician	7.5	2	2	2	3	2	3	2	2	1
2	3	5	4	Paediatrician	7.5	2	2	3	2	2	2	2	2	2
18	4	5	4	Paediatrician	12.5	2	2	2	2	2	2	0	0	1
27	2	5	5	Paediatrician	10	2	1	2	2	2	2	2	2	2
3	3	5	5	Paediatrician	5	3	3	3	1	1	1	3	3	1
9	3	5	5	Paediatrician	15	2	2	2	2	2	2	2	2	1
1	4	5	5	Paediatrician	5	2	2	2	1	2	2	2	2	2
21	4	5	5	Paediatrician	5	4	3	3	2	3	2	2	3	2
13	2	4	3	Psychologist	10	2	2	3	1	1	1	3	1	1
16	2	3	3	Psychiatrist	10	2	2	4	1	2	2	2	3	1
8	5	2	2	Radiologist	0	2	1	2	2	1	1	1	1	1
10	4	3	3	Orthopaedic Surgeon	5	4	3	3	2	3	3	3	3	2
19	4	4	4	Orthopaedic Surgeon	3.5	2	2	3	2	3	2	2	3	2
25	4	5	4	Orthopaedic Surgeon	5	4	2	3	3	3	1	2	2	1
7	2	2	3	Urologist	7	2	2	2	1	3	3	1	1	1

Part Two: Written results of the survey to determine the expectations of physicians in Rancagua prior to the implementation - comments

*** means that the reply was illegible

Question 2.2 What expectation do you have with respect to the time used in direct patient care in the examining room once the new system is implemented?

2 By taking less time to write out the chart, one can optimise the time to attend the patient.
*4 One will use less time to write out prescriptions; observation of pathology ***
5 information will be available immediately
*6 one will have to dedicate time that used to be dedicated to the patient to write and complete the information that is required.
7 if it takes less time to write, it will improve the time for talking to the patient and examining them.
8 The system will be more agile, complete and effective.
11 loss of visual contact with the patient
13 Fill out the chart more rapidly and access to the complete medical chart
*15
17 faster access to the information (medical record, lab test results, etc).
18 reducing the time to write in the chart will permit an improvement in the personal relationship
19 should spend less time in filling out forms, visit records, lab requests, x-ray petitions
*20 if a format is made available to complete patient data, one would not spend time in writing about the medical history of the patient.
*21
22 Until one is able to manage well, everything will be slower.
23 less time for the patient
24 by having to fill out less paperwork (prescription, lab requests, medical leave forms, etc.).
26 It is better depending on the speed of entering the information in the electronic patient record
*27 More time in contact ***
28 If filling out the chart is faster, there will be more time for the patient examination.

2.3 How do you think that the use of an electronic patient record will affect the relationship that you have with your patient? Why?

1 more time available to improve the subjective (anamnesis) and physical exam
2 even if there were 1000 computers between two human beings, if one knows how to manage the situation, there won't be any problem.
3
4
5

6 In order to dedicate time to filling out the chart, I won't dedicate all the time I can at present to the patient.
7 The patient will realize that there is modern technology at their service. This will improve the quality of care.
8 There will be more time for the patient with more complete information about him.
9 Complete information, patient chart. Greater detail about the active problem.
10 I think that the patient could feel uncomfortable and depersonalised.
11 More impersonal
12
13 For therapeutic conditions, the way the it could influence the relationship between the therapist and the patient.
14
15
16 More impersonal contact, considering above all my speciality (psychiatrist).
17 It will improve the speed of access to information.
18 Always (or almost always) available, more complete and detailed information
19 Will be able to process the same information more quickly
20 I believe that there will be better visual contact that he is writing.
21 It will not affect the doctor - patient relationship
22 At the start I will be more preoccupied with doing things well than I will be in the patient.
*23 ***
24
25
26 With the measure that the user familiarises himself with the system
27
28 Because the patients are interested that we do things well

2.4 How do you expect the information system to impact the amount of administrative information that you receive about your patients?

1 by being a faster system, for the coding of illnesses
2
3
*4 All the information that will ease the *** of the patient is great; for ***
5 hoping that the administrative staff does it well
6
7 There will only be one unique chart for one patient, that you can evaluate with greater speed the clinical and administrative aspects
8 More data and information
9 More objectivity
10 I suppose it will improve given that presently I have no information
11 More order
12
13 Faster, more efficient, more complete. Better accumulation of information
14

15
16 Online access to information
17 Speed of the information and the manner of identifying the patient and the other related data.
18 Won't interrupt the appointment with the telephone, clear information, clear writing
19 It is important to have access to other data for example number of days of previous medical leave
20 You will know data that the patient doesn't know or doesn't remember
*21 ***
22 I will have access to things that I presently do not know
23 I don't know
24
25 More complete information
26
27 Precise data that is in order
28

2.5 How do you expect the clinical information system to impact the amount of information that you receive about your schedule? Why?

1 Faster knowledge of my scheduled appointments
2 You don't have to wait for the secretary to get off the telephone in order to communicate with her3
*4
5
6
7
8 More order and greater information
9 Better utilisation of the appointments available
10
11 More order
12
13 for standardisation
14
15
16
*17 To acquire *** will be faster, better control of resources, better scheduling of doctor's time, the time of arrival of patients etc.
18 Tells who arrived first, who is not coming, etc.
19
20
*21 ***
22
23 I don't know
24
25

*26 A photo of the chart, the schedule * and dynamic
27 Precise knowledge
28 Because the information is instantaneous

2.6 How do you expect the clinical information system to impact the amount of clinical information that you receive about your patients? Why?

1 I suppose that the information will be multidisciplinary
2 they won't lose the charts, there won't be a delay in looking for them
3
*4
5
*6
7
8 More order and greater information
9 True detail about each appointment
10
11
12
13 More complete and gives useful information about the medical history, previous psychology, and the nuclear family
14
15
16
17 Greater accessibility to the clinical history, other appointments with different specialists (other doctors), etc.
18 Clear writing, information available about other appointments, exams etc.
19 We should have access to the appointments for other pathologies
20 having the complete medical history, one can work with more confidence.
21 Greater information
22 The patient will have only one chart
23 I don't know what is the system to use.
24
25
26 Follow up on the information
*27 More current data and ***
28

2.7 How do you expect the information system to impact the patient care in general? Why?

1
2
3
*4
5

*6 When the whole system ***
7 More time to attend the patient and less time for writing
8 Everything will be faster and easier
9 Better information
10 It should be the same
11
12
13 For therapeutic conditions, the way that it can influence the relationship between the therapist and the patient.
14
*15 ***
16
*17 ***
18
19 By having better information and at the end, more time to dedicate to the patient care.
20 There will be greater communication
*21 ***
22 The patient will be seen as a whole
23 the same
24
25
26
27
28 It is positive for the patient that more time can be dedicated to the direct care and will not be lost in the part that is administrative.

2.8 How do you think that the information system will impact the patient satisfaction that it receives from [the health care company]? Why?

1 Faster, more efficient
2
3
*4
5
6
7
*8 ***
9 Multiple information more quickly
10
11
12
13 Speed and efficiency
14
15 More precise systems.
*16 I don't believe that the information system will *** directly on medical care (clinical at least).

17 Improve the speed and efficiency in attention from the moment that they arrive at the reception until they leave the examining room.
18
19
20 For image, it will be hard to have the examination room implemented well.
*21 ***
22 General vision
*23 I don't think that it will influence the *** - positively
24
25 More modern image
26 Information that is secure, trustworthy, rapid, follow up, referrals
*27 ***
28 Less time to wait. Avoid the possibility of losing the patient chart.

2.9 How do you think that the clinical information system will impact your ability to do research about the health of your patients?

1 You can obtain data more easily by searching the patient charts. Improve the statistics.
2 By having easier facility to obtain data, use of statistics, etc.
3
*4
5
6
7
8
9 Complete and standardised data
10
11 Better accessibility to data
12
13 Access to the database and quantitative analysis
14 Rapid access
15 Database > and instantaneous
16 More information
*17 Note the data, order it, ***, relate it, etc.
18 Facilitates the recuperation of data
19 Easy access to the data.
20
*21 ***
22
23
24
25 Easier access to the information
26 Depends on the future implementation and according to the complexity of the information
27
28 Because all the information will be standardised

2.10 Do foresee a specific problem that the installation of a clinical information system will cause?

1 Learning. Everything that is new will provoke a certain amount of rejection.
2 No, if we learn how to use it well, and we can have help in the case of doubts (at the moment of doubt).
3 Time in my case because I don't have training in the use of the computer.
*4
5 No
*6 Initially all the problems; I hope that ***
7 One uses abbreviations when one writes, I don't think that everyone will understand my abbreviations or those of the rest of my colleagues.
8
9 No
10 I don't think that it will bring benefit to the group or personally
11
*12 ***
13 For therapeutic conditions, the way that it can influence the relationship between the therapist and the patient.
14 It is impersonal.
15 The lack of knowledge of the people that have to use it.
16 Preferably at the start, one requires a process of training, initially the lack of familiarity will generate difficulties.
17
18
19
20
21 The problem of not knowing how to use the system
22
23 In the time dedicated to the patient
24
25 I don't see any
26 Problems in the inicial adoption of the system
*27 Personally, in the knowledge * of the system
28 The practical problem that a system failure will produce. Loss of the confidentiality between the doctor and the patient.

2.11 Can you suggest a way that we can improve the installation of the clinical information system?

1
2
3 To be in training continuously
4
5 More training

6 It is fine the way that it is progressing
7 No
8
9 For now, no
10 I don't have experience
11 An ergonomically designed desk
12
13 No, not without knowing what it will be
14
15 Personalised training
16
17
18
19 A trial period with both systems (computerised and manual)
20
*21 Computer courses and practice ***
22
*23 ***
24
25
26 Installation of other specific software - graphics, educational
*27 ***
28

2.12 Is there some problem that currently exists that cannot be resolved with the clinical information system?

1 No
2 No
3 The doctor patient relationship.
4 Yes, the impoliteness of some doctors in front of their patients.
5
*6 ***
7
8
9
10 Yes, rapid and expedited communication
11 Catastrophic illnesses.
12
13
14 No
15 Yes, CDO hasn't contemplated in the database some common situations
16
17
18
19

20
*21 ***
22
23 It depends on the system
24
25 The problem of correct diagnosis.
26 Educating the user about the utility of computerising for their health, one could get over some specific cases.
*27 ***
28

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