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# Evidence Based Decision Making in Healthcare

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# **Evidence Based Decision Making in Healthcare**

## **-Understanding the Current Information Environment-**

**A project submitted in partial fulfillment of the requirements for the  
Master of Science in Information Systems**

**Dakota State University**

**2004**

**By**

**Karen J. Hildebrand**



**MSIS**  
**PROJECT APPROVAL FORM**

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## **Abstract**

The Regional Health Authority – Central Inc. provides healthcare services to a population of approximately 98,000 people in a geographically diverse area. The region is looking to understand the current information environment in which it operates in specific regards to Emergency Room visits. This study looks to understand what is currently available, how this existing info-structure can be better utilized, and what the future information systems goals of the region should be.

In order to accomplish these goals three sites were chosen as representative of the regions' facilities, Boundary Trails Health Centre, Altona Health Centre and Rock Lake Health District Hospital. The information systems at each of these three sites were evaluated in regards to current practice. The Boundary Trails Health Centre is currently using electronic information systems for data capture, whereas the Altona and Rock Lake facilities are using manual methods. The evaluation of the three information systems processes resulted in several recommendations.

The Regional Health Authority – Central Inc. should move towards a standardized method of data collection and submission. The healthcare environment is rich with data, which would provide decision support benefits to the RHA-Central if the data could be compared across facilities, areas and region-wide. Submissions of the patient log and the financial records should be standardized across facilities, and purchase of a statistical software package to analyze the data submissions in combination with hiring an individual with the skill set to provide decision support should be a priority in order to provide management with evidence for decision support.



The region would benefit by creating a service-based policy in regards to distribution of forms, as currently facilities are being provided with forms regardless of the services they provide. Creating a service-based policy would allow the region to provide the facilities with the forms appropriate to the services offered. This measure may also help to lower costs by reducing the volume of forms needed. Attention should also be devoted to the design of the forms, specifically in regards to the location of the variables. Logical workflow should be taken into consideration in order to encourage data capture and thus improve information accuracy.

Opportunities also arise in regards to creating site-specific electronic patient indexes (EPI) in building towards a regional EPI. An electronic system that stores a patient's demographic information would help in both patient and staff satisfaction, while improving data capture and case completeness. Decreasing the administrative overhead associated with a patient visit would in turn allocate greater time to patient care effectively creating efficiency within the system.

The future of healthcare information systems looks to the implementation of electronic patient records (EPR). The RHA-Central should consider the implications of such an implementation, networking, data security, hardware, software and user needs. The opportunities to be leaders in this field may be boosted by programs such as the Canada Health Infoway that enable such developments through funding.

The RHA-Central Inc. has a tremendous opportunity to capture the data passing through the information processes electronically. In so doing, the region looks to provide itself with a rich source of data upon which to base decisions and identify both strengths

and weaknesses. Leveraging the current information system processes while planning for the future is fundamental to the business processes of the RHA-Central.

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# Introduction

The Regional Health Authority – Central Inc. serves over 98,000 people in rural Manitoba. The region is geographically diverse, spanning 18,500 square kilometers, and includes numerous communities of varying size and demographic factors.

Approximately 3,200 people are employed by the RHA – Central Inc. in a variety of facilities. The RHA has 14 acute care facilities, 15 personal care homes, 11 home care offices, 13 public health units, 8 mental health offices, 14 Services to Seniors community resource councils, and 14 ambulance services<sup>(23)</sup>.

The province of Manitoba funds the operations of the RHA – Central. Due to fiscal constraint the budget of the RHA is decreasing, and therefore, it is important that efficiencies are realized, and productivity be increased. It is in this environment that the importance of information is being recognized. As emergency care is an increasingly expensive operation it is important to understand what the current information systems are, and how they can be better aligned with the organizational goals.

This paper will address the current system, and present a concept for a future system. Analysis as to the process of converting the current system to the future system will be discussed at length, with a summary of recommendations for consideration.

## **Current Systems**

The analysis of the current information systems in RHA-Central focuses on three facilities that were chosen as representative. The three facilities examined are Boundary Trails Health Centre, Altona Health Centre, and Rock Lake Health District Hospital. Boundary Trails Health Centre was opened in May 2001, and it is located between the communities of Morden and Winkler, servicing approximately 50,000 people. Boundary Trails is an accredited 94-bed acute care facility, offering six emergency rooms, and four observation rooms to emergency patients. The Altona Health Centre is located in the East area of the region, servicing approximately 6,000 community and area residents. The facility was opened in 1995, and is an accredited 22-bed acute care facility. The Rock Lake Health District Hospital is located in Crystal City serving approximately 2,500 people from the town and surrounding communities. The facility opened in 1980, upon the amalgamation of the Crystal City Memorial Hospital and the Pilot Mound Nursing Unit. The Rock Lake Health District Hospital is an accredited 16-bed acute care facility <sup>(23)</sup>.

Due to the size of facilities, and communities serviced, these sites were chosen as representative of the RHA-Central. The information systems in these hospitals varied greatly from an electronic system, Medi-Patient, installed at Boundary Trails Health Centre, to a manual system in both Altona and Rock Lake. The following explanations correlate with site visits to each facility.

### **Current System: Boundary Trails**

The Boundary Trails Health Centre utilizes an automated patient registration system in serving Emergency Room (ER) patients. The system, Medi-Patient, is the backbone of the patient information systems within the facility. Upon presentation to the facility a patient encounters the registration desk. It is at this desk that the Medi-Patient system is first accessed in order to either retrieve a patients' information, or to create a new patient record (Please refer to Appendix A, Figures3-6). A patient who has previously visited the Boundary Trails facility will already be in the Medi-Patient database allowing their demographic information to be retrieved and used in the current case profile. Case specific information is then completed in order to document the reason for the visit. The demographic and case specific information is compiled and output to a printer that produces the Emergency Record Form (Appendix A). The form is printed in triplicate and is stapled together at which time the patient is instructed to take the form and place it in a box at the nurses station. The nurse assesses the patient and documents all pertinent information on the hard copy ER form. The physician, upon assessment of the patient, documents the visit on the ER form as well. Additional testing may be required of a patient where additional forms will be attached to the ER form. Upon completion of the patient visit the ER form returns to the registration desk. The staff at the registration desk is responsible for data entry of the case information into the Medi-Patient system. The ER form is stored in "active" status for two weeks at the registration desk prior to it being split. Once the form is split a copy is sent to the physician clinic and for patient follow-up, and copy is sent to finance for billing of the ER visit <sup>(10) (11) (24)</sup>.

The Medi-Patient system provides several key strengths to the information system at Boundary Trails. The system works effectively as a patient index allowing timely and efficient retrieval of patient information. Drop down lists and built in business rules ensure that the data is entered in a standardized fashion and is complete prior to allowing a user to advance screens<sup>(10)</sup>. With a staff of 15 employees at the registration desk, completing up to 100 forms per shift this system enforces standardization improving the integrity of the data. Auditing of the system commenced in January 2004, with measures looking at the completeness of accident information, correct selection of minor activities, physician and nurse assessment times, correct discharge selected and changes being recorded as required. The initial assessment in January 2004 showed an error rate of 16%. Training and staff awareness as to the need for completeness in assessment times and accident information have decreased the error rate to 3.8% in May 2004<sup>(11)</sup>. This decrease is quite substantial, and is noteworthy in that it has successfully increased the capture of assessment times and accident information. The goal of a 2% error rate has been established as a benchmark that the facility should strive to achieve. The auditing process is important in providing feedback to the users and is essential in improving data capture and completeness.

Although the Medi-Patient system demonstrates several positive measures there are several drawbacks. The most concerning drawback is the lack of ad hoc reporting capabilities. The Medi-Patient system is capable of creating a wide variety of reports, however these reports are included in the Medi-Patient system and are not customized to suit the users reporting needs. This equates to an abundance of reports being created in order to retrieve the necessary information. Unfortunately such over reporting tends to



lead to information overload, and diminishes the effect of the information. Providing only the information required on a fewer number of reports may encourage the use of Medi-Patient as a source of information. The second downfall with the system is that Medi-Patient is running on a network that fails on a reliable basis. This is an issue that greatly restricts the use of the electronic system, and largely undermines the purpose of having such a system. Currently, when the system is unavailable due to networking problems the registration staff must revert to the manual paper based method, which creates workload issues when the system is recovered and there is a backlog of data to be input. Improving the network stability, and creating redundancy would allow for greater confidence in the system, and is essential in mobilizing the system.

### **Current System: Altona Health Centre**

The Altona Health Centre is a progressive facility, which is almost exclusively manual in its information systems in regards to Emergency Room (ER) patients. As is demonstrated in Appendix B, Figure 1, an ER patient presents to the nurses station. Either a ward clerk, or nurse (RN, LPN), or nurse's aide will then create an emergency report form. This form requires manual capture of all variables listed in the data dictionary (Appendix B). Upon entry of demographic and visit information the form travels to the nurse for patient assessment and visit specific information capture. This includes the patients' status as well as the time of nursing assessment. A patient is then assessed by a physician in regards to their entrance complaint, at which point a direction as to care is decided upon. The physician then transcribes their information on the patient form. After completion by a physician, the form is reviewed by a nurse ensuring its completeness as to data entry, whereby it is returned to the nurses' desk <sup>(28)</sup> <sup>(27)</sup>.

Once a patient visit form is complete it is sent for processing. This processing involves ensuring that the form is accurately completed to the best ability possible. In cases where demographic information could not be collected completely from the patient (ie. no health card when presented at ER), it is retrieved from the patients index card. This index card is retrieved for every visit in order to complete the medical record number field on the Emergency Report Form. Some patients will not have a medical record number, as they have not been an in-patient, in this case the field is left blank for later assignment <sup>(16)</sup>.

Statistics for the region are calculated using a patient log. The Altona Health Centre uses an Excel spreadsheet for this purpose <sup>(16)</sup>. Please refer to Appendix B for a full listing of the information captured.

The forms are then split into the three copies, with one being sent to the clinic for physician billing, the second being forwarded to accounting for visit billing, and the third being kept for filing in the patients chart.

At the end of each month several submissions as to Emergency Room patients are required by RHA-Central. The first is summary statistics, which are calculated, based upon the monthly patient log. These summaries are submitted to the Director of Health Information Services <sup>(16)</sup>. Also submitted, are the financial statistics. Categories for submission include Ambulatory Care – By Responsibility, Ambulatory Care – By Visit, Ambulatory Care- Visits by Shift, Meal Days, Laundry, Adult Day Care Program and Incidents. A bill is submitted to Manitoba Health, or to those responsible for payment per individual. This bill is a total of all ER visits a patient may have had during the specified time frame <sup>(15)</sup>. Also at month end, visit forms for the month are filed into patient charts. This is a time consuming task, which for ER visits alone can take up to eight hours. Upon filing of the form, the ER visit information is considered complete <sup>(14)</sup>.

The Altona Health Centre information system for Emergency Room patients is largely manual. Electronic systems are used primarily as tools to summarize the data from multiple patients. Issues that result from a manual system, can be concerning specifically in regards to data integrity. Patients in an emergency situation do not consistently bring with them the information necessary to complete their demographic

information (ie. MHSC, PHIN). This can result in data quality issues, but ultimately will not affect patient care.

The current system also makes the expectation of a new form for each patient visit unrealistic, specifically for high volume patients. Manual capture of information is considered too time consuming, and would ultimately interfere with more urgent activities. Therefore, in the current system, forms can be used for multiple visits to eliminate duplication. Although this may lead to fewer data errors, it is not considered best practice as determined in the spring 2003 review by the College of Physicians and Surgeons, and thus should be considered for improvement.

Issues as to the completeness of the forms were also of concern. Of specific interest was the recording of time of treatment. These variables, both nursing and physician treatment time are used in calculating waiting times for ER patients. Although the treatment times recorded by nurses are considered to be fairly consistent, it is of interest that of the 585 ER visits in April, only 171 had the variables completed that are necessary to calculate wait time. A completion rate of 29% illustrates a systemic problem in the capture of treatment time variables. This issue is of concern, and was identified by all individuals interviewed on the site visit <sup>(14) (15) (16) (27) (28)</sup>. However, identification of the issue has not seemed to solve the problem, therefore additional measures should be sought to eliminate this issue.

### **Current System: Rock Lake Health District**

The Rock Lake Health District Hospital is a contract facility for the RHA-Central. Its information systems are exclusively manual in regards to Emergency Room (ER) patients. Upon patient presentation to the reception desk, an Emergency Report Form is created for the visit, and demographic information is collected from the patient. If the patient has visited the hospital before their index card is retrieved, as this card contains all of a patient's demographic information. Visit information is then recorded specific to the individuals' complaint.

The patient form is then forwarded to the nurses' station. The nurse assesses the patient and records the collected information on the ER Form. The physician then uses the form for recording, based upon their examination of the patient. Upon completion of the ER Form it is returned for visit processing.

A visit is processed by entry into a logbook. As nurses may complete the ER Form when HIS is not on-duty, the logbook is kept manually. The nurses' station at Rock Lake Health District Hospital does not currently have a computer workstation to aid in maintaining an electronic version of the logbook. However, interest was expressed in having a standardized electronic logbook throughout the region.

Upon completion of the log, the form is split, with one copy going to the physicians' clinic for billing; the accounting copy is forwarded to Finance if billing is not to Manitoba Health. For Manitoba Health claims the accounting copy is filed, and a claim is submitted. After one month of "active" status the patient copy is filed in their medical chart. Month end statistics are compiled from the logbook and submitted to the Director of Health Information Systems <sup>(9)</sup>. Please refer to Appendix C, Figures 1 and 2.

The Rock Lake facility operates in a manual environment without the support of electronic systems. The method is consistent with the availability of the supporting technology. However, options such as an electronic logbook were discussed and were of interest, specifically should they be standardized throughout the region<sup>(9)</sup>. The benefits of mentioned included ease of creating summary statistics for submission, as well as comparison between facilities.

The concept of a hierarchy of forms was also discussed. A system much like policy based access for computing systems was talked about, in that facilities such as Rock Lake, which offer a limited range of services should be provided with forms only for those services. Facilities such as Altona would then be provided with forms that reflect the services they provide, and Boundary Trails would have forms reflecting their services. It was observed that there is a number of forms being stored at each facility, for which the service for which they apply, are not offered. Creating a hierarchy of forms may be cost saving, specifically if the forms are being custom printed for each facility.

Also discussed were emergency plans in regards to patient information. Specifically, in the event of a disaster, how the current system would be interrupted. Although the index card boxes containing patient demographic information are supposedly fireproof, the medical charts are not in any type of protective cabinet. Also observed was the physical security of the medical charts and the index cards were very preliminary. Distrust as to a computer system to replace the index cards was voiced. However, if such a system were introduced, backup and data redundancy measures could be greatly improved.

# Solution Analysis

In analyzing the current state of information systems throughout the three facilities, it is apparent that some form of standardization across the region would be beneficial. Standardization allows for direct analysis of the data retrieved from each site, without having to take into account the business rules applied on a site-by-site basis. As the region has progressed into providing services for 98,000 people it is important that there be a system in place in which data can be analyzed.

It can be concluded that the region should move towards implementing a region wide Electronic Patient Record, and Electronic Patient Index. However, there are a number of actions that could immediately impact the system through increased productivity, and improved information capture. Essentially, the issues that face the system can be broken down into three categories: immediate solutions, intermediate solutions, and long-term solutions. All three of these categories will focus on the goal of a standardized Electronic Patient Record and Electronic Patient Index.

## **Immediate Solutions: <1 month to implementation**

The following solutions are categorized as immediate solutions based upon the assumption that the majority of the hardware and software necessary to support the implementation is already available and familiar to the proposed user community. These assumptions are based upon the technical experience of the individuals interviewed at each site.

1. Develop and distribute a standardized electronic patient log
2. Collect not only statistical summaries, but the log from each facility

3. Develop and distribute a standardized electronic financial reporting system for patient visits.
4. Create a service-based policy in regards to form distribution

Standardization to an electronic patient log can be achieved relatively easily, as the Altona facility has already developed an Excel based log <sup>(16)</sup>. Although it is realized that each site may collect additional variables, a core set of data should be captured. Please refer to Appendix D for the recommended standard log based on the log developed in the Altona Health Centre. Basing the patient log on one already developed encourages the transfer of skills within the user community. Training within occupational groups also improves standardization in the way, in which the data is collected, which is the ultimate goal of a data collection system.

The solution described above will provide the basis of a data warehouse, which can be used as a data source for a decision support system. A wealth of information is currently being collected at each site, however it is being kept at the site level. Standardizing the format in which this information is being captured would allow for direct analysis and comparison both within and between sites.

Efficiencies may also be realized by creating a standardized format in which financial reports are collected and submitted. Across sites, it appears that the way in which the data was collected throughout the month, and then summarized for submission varies. It was discussed that the financial reporting systems were inherited when the RHA-Central was introduced. Therefore each site was able to keep their specific method of data collection. Although this was a good decision in regards to allowing the user community to continue operating systems they were comfortable with, it is creating data



islands. A standardized method of data collection and reporting would help to create consistent business rules, which describe the financial system used in RHA-Central facilities. In so doing, this data can also be used in a decision support system within the organization.

The final recommendation, of creating a service-based policy for form distribution, could be quickly achieved by analyzing the services each site offers. Facilities should only be receiving forms for the services that are being provided. Creating this service-based policy may aid in eliminating reproduction costs for unnecessary forms, and limit the volume of forms being printed for specific services.

#### **Intermediate Solutions: 1 to 6 months to implementation**

The following solutions are categorized as intermediate solutions as they will require additional sources of funding, or a longer time frame for development and implementation (within 3-5 months). These recommendations rest upon the foundation built by implementing the immediate solutions.

1. Implement on a site-by-site basis a standardized patient registry database containing patient demographic information.
2. Purchase a statistical software package to analyze the data being submitted in a standardized way region wide (ie. patient log, financial reports)
3. If not already employed within the RHA-Central, hire a skill set in data retrieval and analysis.
4. Re-design Emergency Report Form to encourage completing variables

In moving towards an electronic patient record and region-wide electronic patient index, a site database of client registries would be a strong intermediate solution. At both the Altona and Rock Lake sites index cards were being used to store patient information. Although this is a practical system, it has several major flaws. First, the data is only accessible when the locations where it is stored are unlocked; therefore on night and evening shifts it is necessary for nurses to gain access to the area in order to retrieve the index card. Secondly, each site did not have the index cards kept in a secure location that could withstand a disaster. The alternative of keeping this information in a database would allow for easy backup and storage at a remote location, often a bank vault, which can withstand natural disasters. Such a database would not only provide better data security, but more timely data access. In an emergency situation, time can be critical, and a database can quickly make available patients information, such as emergency contact, medical alerts and allergies that may be crucial to a patients care. In a less emergent setting such a database would eliminate data transcription errors, allow for completed forms regardless of patients ability to provide PHIN numbers, and would ultimately allow for a new form to be completed for each patient visit as was indicated as best practice. Eliminating the need to transcribe the demographic information would speed the process of creating the Emergency Report Form. As the time it takes to complete the forms was an issue such a database would provide a valid and an economically feasible solution. The database could be easily be powered using Microsoft Access, and a web interface could be used on the facility Intranet to access the data. Such a configuration could, at most facilities, be hosted on a workstation eliminating the cost of additional servers.

Two implementation approaches could be used in regards to the site-specific electronic patient index. The first, a start date forward implementation, would provide the user with the database and web interface. The database would go live and data would be entered as patients presented to the Emergency Department. The second option, a back date build would involve entering the information contained on the patient index card into the database prior to its going live. This would be the preferred method of implementation, as it ensures that the data is entered for all patients who have previously visited the facility, eliminating the concerns of missing variables. A start-date forward implementation does not remove the problems associated with patients not having the appropriate information upon visit presentation (ie. no MHSC). However, a back-date build means that a large volume of data must be entered into the system. This could be achieved while maintaining current services through the hiring of temporary workers, or realignment of existing duties to support the data input needs. Prior to going live, it would be important to eliminate any transcription errors that may have occurred in the data input process through data cleaning techniques. The process of data cleaning helps to eliminate business rule errors, such as multiple PHIN numbers assigned, or records with the same first and last names and same date of birth. Such cleaning techniques are commonly assigned to a database administrator, a role that could fall within the job description of the data retrieval and analysis position.

An issue that was discussed at each facility was the availability of reporting capabilities, and the feedback provided to each facility in regards to the data submitted. In the current system it was felt that there is no method of region wide data analysis for ad-hoc querying and reporting. However, the data is available to support such a system.

With the increased influence of evidence-based decisions, moving towards a source of decision supporting tools would be strategically advisable.

There are a variety of products available that would suit the needs of the organization based upon the current information environment. As the RHA-Central would most likely initially employ only one individual with such a skill set purchasing the software would be economically feasible. Mid-priced, high power products such as those marketed by SAS or Cognos would best suit the needs of the RHA. However a wide variety of such packages are available. Consideration must be given as to the availability of the skill set required to run such programs as most run on unique programming languages. A statistical software package should be evaluated on its ease of use, as well as its ability to both import and export data, specifically from Excel in this case. The package should be able to provide a variety of statistics, cross-tabulations and calculations regarding the influence of variables. Predictive modeling is also of importance, especially in providing decision support to management. The two vendors mentioned previously also offer a data-mining package, which looks specifically to discover relationships that were not immediately apparent within the raw data. This type of tool might be particularly useful in evaluating preventative measures, and their effect on the patient population. It is also important to remember that the amount of data being analyzed will grow, so it is essential to purchase a system that is able to process large volumes of data. Currently the Manitoba Centre for Health Policy, Manitoba Health, and CancerCare Manitoba are using SAS software. Programming compatibility with these data sources may be of benefit to the RHA and should be considered, specifically in regards to the opportunities of data linkage.

In order to successfully analyze the data and retrieve meaningful information it will be necessary to employ a skill set with these abilities. Specifically, the ability to use the statistical software package selected. This skill set may already be present in the Information Systems staff or Epidemiology staff. However, if it is not present, such a skill set would play an integral part in decision support by providing the evidence necessary to make informed decisions. This position could incorporate both a decision support component as well as a database administrator component. Specifically, the database component could correlate with implementation, and quality control of the electronic patient index databases.

Finally, the re-design of the Emergency Report form to encourage variables to be completed is an easy solution to what appears to be a systemic problem. Currently wait times are being assessed both within the RHA and province wide. However, on the site visits it was apparent that the variables needed for wait time calculations were inconsistently completed. However, the locations of these variables on the ER Form are not easily recognizable and intuitive to complete. Recommendations such as moving time variables to beside the signature fields may increase the rates of completeness. A trial of new designs could be conducted in association with the introduction of the patient database. The partnership between form re-design and implementation of the patient database would incorporate the two driving influences behind re-design, namely a new system for recording demographic information, and the need for better form completion rates.

## **Long-Term Solutions: >6 months**

Although the solutions suggested above will bring the RHA into better standing in regards to information collection and decision support, they are ultimately only the tip of the iceberg. The future of healthcare is in the Electronic Patient Record (EPR).

However, there are many considerations, which must be evaluated prior to region-wide implementation. Currently the Medi-Patient system is the system most likely to resemble an EPR, however in its current state it is not viable for it to be considered in such a light<sup>(18)</sup>. Currently it is being used primarily as a graduated client registry. There are several issues that are restraining Medi-Patient from EPR status, and they are as follows:

1. Network stability
2. User buy-in
3. Immobile
4. Site not yet conducive to an electronic environment
5. Limitations of Medi-Patient system

For an EPR to be viable the network on which it is run must be stable, reliable and redundant. In the situation of ER patients it would be unacceptable to experience a fail over of 1 minute. However, the Medi-Patient network on which the system is running fails at least once a week, for extended periods of time<sup>(10)(11)</sup>. This is unacceptable, and may explain the lack of user buy-in.

It is the basis of system development that a system should provide more than what the users would expect. An EPR system that goes down at least once a week is much less than a user, or a patient would expect. This system/network failure creates mistrust in a system, which may be the future of RHA – Central. It may take several iterations of

network development to solve the problem, however it is also in the best interest of those trouble shooting the network to ask the users what the problems are and create a feedback channel.

The Medi-Patient solution is also currently immobile. Data entry is completed at the registration desk with physician and nurse information being captured on paper forms as in other facilities. An Electronic Patient Record must take into consideration best practice, which includes having patient information easily accessible to the care providers, yet, secure from intrusion. The Boundary Trails Health Centre is not yet equipped to handle mobilizing the Medi-Patient system.

The registration desk is currently doing data input into the Medi-Patient system for ER patients. This means that the nurse and physician assessment as well as any associated test information is all being duplicated. It is being manually written on a form, which is then manually entered into the Medi-Patient system. This two-step system will most inadvertently equate to involuntary data errors. Having \$1.4 million in sunk costs on the Medi-Patient system encourages the need to make it truly an electronic tool for use in patient rooms. However, according to the Medi-Solution website, in order to make the Medi-Patient system an Electronic Health Record, equivalent to the EPR discussed in this paper, it would need to be integrated with at least three additional Medi-Solution products. These would include Medi-Visit, Medi-Result and Medi-Plan, as well as Medi-Lab to interface with the Lab Information Systems.

The shortcomings in the current systems lead to several long-term solutions that should be developed within five years. They are:

1. Create a regional Electronic Patient Index/Client Registry

2. Evaluate Electronic Patient Record (EPR) solutions for best fit to the regions' needs
3. Test several EPR solutions for best fit
4. Select an EPR vendor
5. Develop a wireless networking plan
6. Submit plan for analysis of wireless interference with medical devices
7. Implement a wireless network
8. Collaborate with users to determine best hardware solutions
9. Purchase hardware that reflects users preferences in relation to a wireless EPR
10. Train the users on the new hardware and EPR solution
11. Thoroughly test the system in the real-world setting
12. Implement a standardized EPR solution region-wide that integrates with the existing EPI

The site implementations of an electronic patient index would be best utilized if they were available on an enterprise wide scale <sup>(2) (22)</sup>. This type of system would allow for a patient to attend any hospital within the region, while having their demographic information available to all providers. A client registry of this scale would be particularly useful in determining patient flow, specifically where patients are receiving their health services. For example, a patient from Pilot Mound may receive their care at the Rock Lake Health District Hospital, or Boundary Trails Health Centre, depending on the services required. An electronic patient index would improve client services as well as providing a tremendous data source for workload, and facility planning.



Development of client registries is listed as one of the core objectives of the Canada Health Infoway organization <sup>(6)</sup>. Their mission is as follows; “Fostering and accelerating the development and adoption of electronic health information systems with compatible standards and communications technologies on a pan-Canadian basis with tangible benefits to Canadians. *Infoway* will build on existing initiatives and pursue collaborative relationships in pursuit of its mission.”. The Canada Health Infoway was recently granted an additional \$100 million in the 2004 federal budget <sup>(5)</sup>. The Infoway looks to support projects that move Canada towards an Electronic Health Record. As the second largest RHA in Manitoba RHA – Central has the unique opportunity to be a leader in the implementation of a region-wide EPI solution. Such a project would link directly to the Infoway’s targeted programs, specifically the client registry development program. The Infoway is currently supporting two client registry projects, one led by the Newfoundland and Labrador Centre for Health Information, and the second by Capital Health of Edmonton. These projects have focused on developing a regional approach to patient management, in the support of the transition towards an EPR. The Infoway has not yet funded a project from Manitoba, and the RHA-Central should strongly consider applying for support.

Upon development of an EPI, the region could look to integrating the system with an EPR solution <sup>(4) (12) (13) (20) (26)</sup>. Therefore, when evaluating providers for both the EPI and EPR solutions, integration should be considered, and partnering with a single vendor may provide the best system interface. With the abundance of healthcare information system vendors, the decision can be overwhelming. Therefore, it is important that the user community be involved in the decision making process, specifically in regards to

how well the system would operate within their environment and meet their needs. Several organizations have developed measures upon which to evaluate HIS systems <sup>(3)</sup> <sup>(19)</sup>. Of these awards several providers consistently are chosen as best-in-class. These providers are NextGen Healthcare Information Systems <sup>(22)</sup>., and Allscripts Healthcare Solutions<sup>(2)</sup>. Both of these vendors provide layers of solutions including an EPI, and EPR as well as an integrated laboratory interface. Additional features include HR, finance, appointment scheduling, and web-interface solutions. Both systems are based on a Visual Studio and C++ programming platform, which allows for user customization. Ad-hoc querying and reporting tools are included with each solution to aid in decision support processes. Case studies indicate that each of these solutions have been successfully implemented in a variety of settings, indicating that the system is flexible and scalable to the size of the application setting <sup>(2)</sup> <sup>(21)</sup> <sup>(22)</sup> <sup>(25)</sup>. Selecting a best in class solution may not provide the best fit for the RHA-Central, however these product lines illustrate the key components that should be considered when deciding on HIS.

Although selecting a HIS can be a daunting task there are several key components illustrated in the two systems above that should be considered:

- What is the company background?
- Is the company financially stable?
- Is the company growing?
- How many sites are already using the system?
- What types of sites are using the system?
- How many users/patients can the system accommodate?
- What are the products provided?

- How do these products align with the regional information strategy?
- How do the products interface?
- What is the supporting technology?
- What is the programming platform?
- Is in-house customization allowable? If not what are the associated fees?
- Is there an ad-hoc querying capability? If not what are the associated fees?
- What are the hardware requirements?
- Is the system scalable?
- Will this system meet both our current and future needs?
- Is the interface user-friendly and of intuitive design?
- Does it meet the user needs/requirements?
- What is the user group feedback?
- Is there user interest in this solution?
- Is it a financially viable solution?

The costs associated with an EPR solution can be quite tremendous, however there are several financing options that can make implementation realistic <sup>(8)</sup>. It is common in the electronic environment for hardware equipment to be leased from a supplier. A contract with a single hardware provider ensures standardization, which may aid in repair, and also ensures that there is a replacement schedule, purchases of volume also result in a decreased cost per unit. A lease option generally involves a warranty and optional on-site support. These options may be beneficial considering the geographical diversity of the RHA-Central. In regards to the purchase of software for electronic patient management several options are available:

1. Receive project funding from outside sources (ie. Canada Health Infoway)
2. Purchase the software outright
3. Finance the purchase through a bank or credit union
4. Purchase subscription rights through the vendor

Each of the options above has advantages, and disadvantages. Applying for funding through the Canada Health Infoway provides a way to offset the direct costs to the RHA-Central. However, such applications may fail, and often there is a significant time involvement in preparation and submission of a proposal. Purchasing the software outright allows the RHA-Central to purchase as it sees fit, however the significant dollar value may be fiscally unreasonable, although financing options through banks or credit unions are becoming increasingly popular as a method to purchase HIS products. With the current low interest rates, this may currently be a viable solution, allowing implementation of the system, and allocating the ROI to pay for the interest expense. Unfortunately most banks will repossess the system and all data collected in the system should the payer default on the loan. The final and least attractive option is that of subscription. A subscription from a vendor allows a site to use the vendors products, generally on a per seat basis. However, the vendor retains all ownership rights, and all of the data is collected at the vendor site. Although subscriptions are generally less expensive than purchasing the software, it also gives the vendor complete control over the software and data that comprise the system. This can become an issue when a vendor goes out of business, or as is common in the HIS market, is purchased by another vendor.

Consideration of the financial options available to the RHA-Central is a crucial component to vendor selection. However, in regards to information systems projects it is

also important to exclude sunk costs from influencing the choice of vendor. Sunk costs can prove a financial trap, considering sunk costs can result in additional monies being allocated to a failing project, rather than towards a viable solution. The RHA-Central has at least \$1.4 million in sunk costs associated with the Medi-Patient system. However, Medi-Solution should only be considered as a vendor on its merits, not on the money already invested. If Medi-Patient is not the best solution for a regional standardized EPR it should not be selected simply on the basis of sunk costs.

Upon selection of a short-list of vendor solutions that meet the above criteria, it should be requested that each vendor provide a trial of its solutions. Representative user groups should be selected to test the solutions. A focus group session may be most helpful, as it would allow for video recording of user interaction with the product, which would be useful in evaluating each solution. Small groups also help to eliminate peer influence. User recommendations are critical to the selection of an EPR solution as user-buy in is crucial to the success of a HIS. Evaluating the system against mock patients also helps to determine how user friendly the system is, and how intuitively it is designed. It is the job of the vendor to sell the benefits of the system, evaluating mock patients may help users to identify short-falls. Customization of the system may evaluate such shortfalls, but their identification is essential in determining what product best fits the regional strategy and user community.

An EPR solution must be supported by a vast amount of infrastructure including a reliable, stable and redundant network, and a diverse hardware environment. In order to be a mobile solution, wireless networking is essential. With the development of 802.11a and 802.11g protocols, the 802.11b wireless protocol looks to be obsolete in the near

future. As 802.11a looks to provide a greater number of channels it is most likely the solution that should be implemented. However, the issues relating to this protocol is that signal strength is reduced to almost half of that of the 802.11b protocol. This means that approximately double the number of access points will be necessary to cover the same area. The tradeoff for channels is most likely more important in the majority of clinical settings, as it accounts for professional clustering, when many healthcare providers are within a small area (ie. consulting on lab results). Installing a wireless network properly involves site assessment to evaluate options in regards to physical location of the nodes, and a resulting coverage map. It is important to ensure that there is overlapping node coverage to provide a seamless experience for the users.

Installation of a wireless network also requires an integrated information security strategy. CancerCare Manitoba, a leader in healthcare wireless networking currently employs encryption technology to secure its data. Although wireless networks are enabled with wireless encryption protocol (WEP) security, this type of encryption can be cracked in less than thirty minutes, and therefore is not suitable for a healthcare environment. The site now employs a switch, connecting to a firewall, which provides 128-bit encryption. Each user workstation must have the client installed in order to decrypt any data it receives. Therefore, unsolicited users on the system are able to capture packets, however the data is encrypted and therefore is secure from viewing capabilities. An integrated solution such as this is necessary to ensure the security of patient information.

Once a plan has been developed, it can be tested for medical interference. Testing for interference will identify if there is a need for hard-wiring workstations or eliminating

access points in certain treatment areas. A final plan can be established and implemented based upon the approval and recommendations. After installation, the access points should again be tested to ensure that the access point coverage provides the necessary contact coverage for clinical use.

Simultaneous to the network installation mapping, should be the hardware decisions. Once again, best practice and integration should be considered, specifically in regards to the security interface. The hardware solutions should allow for mobility within the patient areas, as well as within the shared and public spaces. A newly developed solution is the convertible tablet personal computer. A convertible tablet integrates the benefits of a laptop, with the unique capabilities of a tablet. This type of hardware incorporates a keyboard, and a swivel screen that can be adjusted to act like a laptop screen, or can be collapsed over the keyboard to act as a tablet. Improved handwriting recognition allows for notes to be entered into a patient's chart. Also, interesting is the use of voice recognition software to complete a patient's chart. An implementation of this software has improved the conversion to electronic charts and reduces the need to dictate notes. The wide variety of wireless devices that could be chosen are too vast to mention. The key to choosing hardware is again, based on user buy-in. It is important to ensure that the technology chosen has user-buy in, and is not simply the newest or latest gadget. User input should be key in selection of hardware devices.

Perhaps the most difficult task is that of training the user community to interact with the system in a standardized and proficient way. The purpose of going electronic is not only to provide better services to patients, but also to create efficiencies in the system. In a healthcare setting it may be helpful to provide enhanced training to a specific group

of users from each facility or region to create a reference group that can be used when questions arise. As healthcare is unique in that information often needs to be accessed in a time restricted manner, creating reference groups within a facility may decrease user frustration that can result when only off-site professionals are experts in the system.

Finally, prior to the system going live, it should be thoroughly tested in a clinical setting. Once again, mock patients may be used to ensure that the network is accessible, the hardware is properly configured and the user is able to interact with the system. This testing may be incorporated as an enhanced portion of user training. It is important that prior to incorporating users as many glitches as possible have been eliminated, in order to reduce user anxiety and reluctance in using the system. However, users should be encouraged to identify problems so they can be properly addressed prior to the system becoming operational.

Lastly, the system should be implemented, with either a start-date forward implementation, where a patient's health record is electronic as of any visits after a given start date, or it can be backdated. Either solution is viable, and both methods have been successfully used in implementations. A successful implementation is the result of a great deal of background work and should be methodologically planned and controlled. The payoffs of such project management will be a system that is beneficial to the patient, the care providers, and the region.



# Recommendations

In summary the Regional Health Authority – Central has a rich data environment in which expansion of electronic information systems would benefit the user and management communities. The benefits of electronic patient management have been well documented, as has the initiative towards evidence-based decision making. Therefore the recommendations for the Regional Health Authority- Central Inc. are as follows:

## *Immediate solutions:*

1. Standardize patient log and financial reporting systems throughout regional facilities.
2. Submit the standardized patient log to the RHA-Central for data analysis.
3. Create a service-based policy for facility forms

## *Intermediate solutions:*

1. Implement a site specific demographic patient index
2. Purchase a statistical analysis/data mining software package
3. Hire an employee for database administration and decision support position
4. Re-design Emergency Report Form to improve data completeness

## *Long-term solutions:*

1. Implement a region-wide Electronic Patient Index
2. Develop the information environment for an Electronic Patient Record
  - Vendor selection
  - Wireless network
  - Hardware solutions

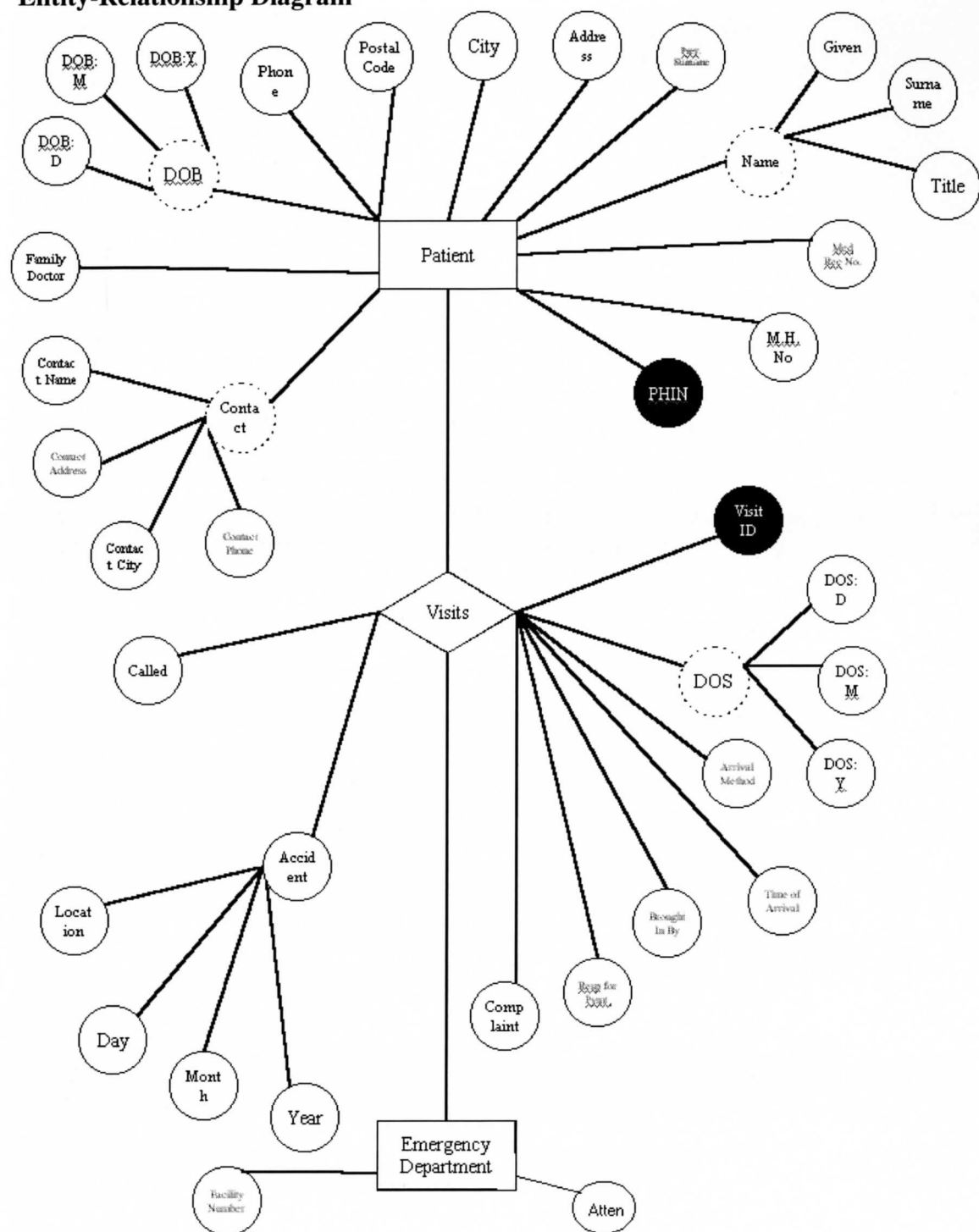
### 3. Implement a region-wide Electronic Patient Record

The above recommendations focus on the current and future needs of the RHA-Central, and take into consideration patient care as well as the fiscal environment in fitting with the organizational Statement of Purpose.

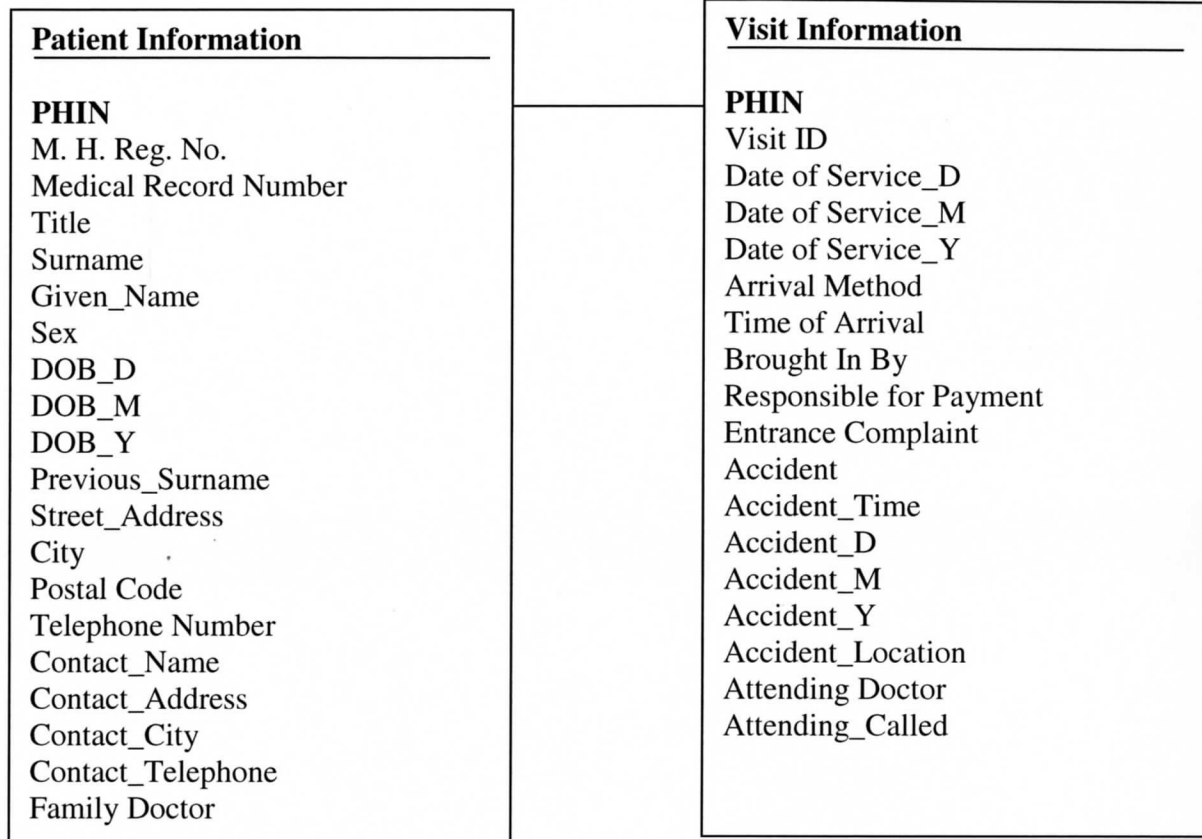
## **Prototype System**

There are several components of the proposed prototype system, which include the recommended standardized electronic patient log, as well as the database design and beta electronic patient index solution. The proposed solution documentation is as follows.

## Entity-Relationship Diagram



## Database Design for Site Specific Patient Index:



## Data Dictionary for Site Specific Patient Index:

<i>Table:</i>	Patient Information
<i>Variable:</i>	PHIN
<i>Acceptable Values:</i>	9 digit value
<i>Business Rules:</i>	<b>Primary Key</b> Mandatory International residents PHIN value of 000000000

<i>Table:</i>	Patient Information
<i>Variable:</i>	M.H. Reg. No.
<i>Acceptable Values:</i>	6 digit value
<i>Business Rules:</i>	Mandatory International residents M.H. Reg No. 000000

<i>Table:</i>	Patient Information
<i>Variable:</i>	Medical Record Number
<i>Acceptable Values:</i>	As per facility
<i>Business Rules:</i>	Optional (accounts for new patients without medical record) Read only

<i>Table:</i>	Patient Information
<i>Variable:</i>	Surname
<i>Acceptable Values:</i>	As per birth certificate
<i>Business Rules:</i>	Mandatory As per patient birth certificate

<i>Table:</i>	Patient Information
<i>Variable:</i>	Given_Name
<i>Acceptable Values:</i>	As per birth certificate
<i>Business Rules:</i>	Mandatory As per patient birth certificate

<i>Table:</i>	Patient Information
<i>Variable:</i>	Sex
<i>Acceptable Values:</i>	M, F, Unspecified
<i>Business Rules:</i>	Mandatory As per patient birth certificate

<i>Table:</i>	Patient Information
<i>Variable:</i>	DOB-D
<i>Acceptable Values:</i>	1-31
<i>Business Rules:</i>	Mandatory As per birth certificate

<i>Table:</i>	Patient Information
<i>Variable:</i>	DOB-M
<i>Acceptable Values:</i>	1-12
<i>Business Rules:</i>	Mandatory As per birth certificate

<i>Table:</i>	Patient Information
<i>Variable:</i>	DOB-Y
<i>Acceptable Values:</i>	4 Digit Numeric
<i>Business Rules:</i>	Mandatory As per birth certificate

<i>Table:</i>	Patient Information
<i>Variable:</i>	Previous Surname
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Optional

<i>Table:</i>	Patient Information
<i>Variable:</i>	Street Address
<i>Acceptable Values:</i>	R.R., Box No. AND/OR Street AND Number
<i>Business Rules:</i>	Mandatory

<i>Table:</i>	Patient Information
<i>Variable:</i>	City
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Mandatory

<i>Table:</i>	Patient Information
<i>Variable:</i>	Postal Code
<i>Acceptable Values:</i>	6 Digit Alphanumeric
<i>Business Rules:</i>	Mandatory Must be 6 digits, may be less to account for International Residents

<i>Table:</i>	Patient Information
<i>Variable:</i>	Telephone Number
<i>Acceptable Values:</i>	9 Digit Number
<i>Business Rules:</i>	Mandatory Include Area Code

<i>Table:</i>	Patient Information
<i>Variable:</i>	Contact Name
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Mandatory

<i>Table:</i>	Patient Information
<i>Variable:</i>	Contact Address
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Optional

<i>Table:</i>	Patient Information
<i>Variable:</i>	Contact City
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Optional

<i>Table:</i>	Patient Information
<i>Variable:</i>	Contact Telephone
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Mandatory

<i>Table:</i>	Patient Information
<i>Variable:</i>	Family Doctor
<i>Acceptable Values:</i>	As provided by patient
<i>Business Rules:</i>	Optional

<i>Table:</i>	Visit Information
<i>Variable:</i>	PHIN
<i>Acceptable Values:</i>	Automatically assigned association
<i>Business Rules:</i>	Mandatory Foreign Key

<i>Table:</i>	Visit Information
<i>Variable:</i>	Visit_ID
<i>Acceptable Values:</i>	System assigned
<i>Business Rules:</i>	Primary Key



<i>Table:</i>	Visit Information
<i>Variable:</i>	Date of Service_D
<i>Acceptable Values:</i>	1-31
<i>Business Rules:</i>	Mandatory System Assigned

<i>Table:</i>	Visit Information
<i>Variable:</i>	Date of Service_M
<i>Acceptable Values:</i>	1-12
<i>Business Rules:</i>	Mandatory System Assigned

<i>Table:</i>	Visit Information
<i>Variable:</i>	Date of Service_Y
<i>Acceptable Values:</i>	4 Digit Numeric
<i>Business Rules:</i>	Mandatory System Assigned

<i>Table:</i>	Visit Information
<i>Variable:</i>	Time of Arrival
<i>Acceptable Values:</i>	24:00h
<i>Business Rules:</i>	Mandatory System Assigned

<i>Table:</i>	Visit Information
<i>Variable:</i>	Arrival Method
<i>Acceptable Values:</i>	1-Stretcher 2-Wheelchair 3-Carried 4-Walked
<i>Business Rules:</i>	Mandatory Lookup Table

<i>Table:</i>	Visit Information
<i>Variable:</i>	Brought In By
<i>Acceptable Values:</i>	Relationship with Patient
<i>Business Rules:</i>	Optional As provided by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Responsible for Payment
<i>Acceptable Values:</i>	1-M.H. 2- Gov't Can. 3-W.C.B. 4-Self 5-Other
<i>Business Rules:</i>	Mandatory Lookup Table According to Patient Self-Report International Residents = Self Payment

<i>Table:</i>	Visit Information
<i>Variable:</i>	Entrance Complaint
<i>Acceptable Values:</i>	Medical Terminology
<i>Business Rules:</i>	Mandatory As described by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Accident
<i>Acceptable Values:</i>	Y/N
<i>Business Rules:</i>	Mandatory Activates Following Accident Questions

<i>Table:</i>	Visit Information
<i>Variable:</i>	Accident_T
<i>Acceptable Values:</i>	24:00h
<i>Business Rules:</i>	Mandatory if Accident As described by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Accident_D
<i>Acceptable Values:</i>	1-31
<i>Business Rules:</i>	Mandatory if Accident As described by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Accident_M
<i>Acceptable Values:</i>	1-12
<i>Business Rules:</i>	Mandatory if Accident As described by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Accident_Y
<i>Acceptable Values:</i>	4 digit numeric
<i>Business Rules:</i>	Mandatory if Accident As described by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Accident_Location
<i>Acceptable Values:</i>	1-Home 2-Workplace 3-Traffic 4-Other 5-Hospital 6-Farm
<i>Business Rules:</i>	Mandatory if Accident Lookup Table As described by patient

<i>Table:</i>	Visit Information
<i>Variable:</i>	Attending Doctor
<i>Acceptable Values:</i>	Doctors employed at facility
<i>Business Rules:</i>	Mandatory Lookup Table

<i>Table:</i>	Visit Information
<i>Variable:</i>	Attending_Called
<i>Acceptable Values:</i>	24:00h
<i>Business Rules:</i>	Optional (if doctor needs to be called) According to time doctor called to facility

## Electronic Patient Index: Screen Shots

**Instructor Login - Microsoft Internet Explorer provided by @Home**

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media History Mail Print Edit Discuss

Address <http://www.students.dsu.edu/hildebrk/Patient/Patient%20Search.htm> Go Links

excite

**Electronic Patient Index**

Search for Patient

PHIN:

[Add a patient](#)

Done Internet

Start Instructor Login - Mic... 10:46 PM

### New Patient:

**Add a Patient - Microsoft Internet Explorer provided by @Home**

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media History Mail Print Edit Discuss

Address <http://www.students.dsu.edu/hildebrk/Patient/addPatient.htm> Go Links

excite

**Patient Index**

**Add a Patient**

M.H. Registration Number:

PHIN:

Medical Record Number:

Title:

Surname:

Given Name:

Sex:

DOB: Day:

DOB: Month:

DOB: Year:

Done Internet

Start Add a Patient - Micro... 10:52 PM

## Patient Found:

http://www.students.dsu.edu/hildebrk/Patient/checkPatient.asp - Microsoft Internet Explorer provided by @Home

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media History Mail Print Edit Discuss

Address http://www.students.dsu.edu/hildebrk/Patient/checkPatient.asp Go Links

excite

### OUT-PATIENT AND EMERGENCY REPORT FORM

**Altona Health Centre**

999999	999999999	6	Miss.	Garner	Williams	F	
2	5	1978		87 Long Beach	Walhalla	MB	R8C3R4 555555555
Willy	89 Long Beach	Walhalla	5555555555	Dr. Moose			

[Visit Information](#)

Done Internet

Start http://www.students... 10:46 PM

## Visit Information:

Add a Patient - Microsoft Internet Explorer provided by @Home

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media History Mail Print Edit Discuss

Address http://www.students.dsu.edu/hildebrk/Patient/visit\_Info.htm Go Links

excite

### Patient Index

### Visit Information

Day of Service: 12

Month of Service: 12

Year of Service: 2004

Arrival Method: 1

Time of Arrival: 11:11

Brought In By: Karen

Responsible for Payment: 1

Complaint: Back Pain

Done Internet

Start Add a Patient - Micro... 10:49 PM

## Form Ready for Printing:

http://www.students.dsu.edu/hildebrk/Patient/Compile.asp - Microsoft Internet Explorer provided by @Home

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media History Mail Print Edit Discuss

Address http://www.students.dsu.edu/hildebrk/Patient/Compile.asp Go Links

OUT-PATIENT AND EMERGENCY REPORT FORM

Altona Health Centre

999999	999999999	6	Miss.	Garner	Williams	F
2	5	1978				
	87 Long Beach	Walhalla	MB	R8C3R4	5555555555	
Willy	89 Long Beach	Walhalla	5555555555			
	Dr. Moose					

Visit Information

12	12	2004	11:11	1	Karen	1	Back Pain	1
11	12	2004	1	Dr. Moose	11:12			

Done Internet

Start http://www.students.dsu.e... 10:50 PM



# Conclusion

The Regional Health Authority – Central services approximately 98,000 people in a diverse geographic landscape. The evaluation of the RHA-Central information systems processes was based on three sites chosen as representative of the region. These sites, Boundary Trails Health Centre, Altona Health Centre, and Rock Lake Health District Hospital, operate in a site-specific information environment. This specificity results in silos of information that prevent region-wide data analysis.

As the movement in healthcare management is towards evidence-based decisions it is important to realize the opportunities for decision support within the RHA-Central. Vast amounts of data are available, and standardization in the way in which it is recorded would allow for the development of a regional data source. In order to find a solution that would best suit the need for data to support decisions, consideration was given to the skill sets available to implement recommendations in combination with the financial viability.

It was evident that the RHA-Central is a rich data source. Harnessing the power of the data should be the driving forces, specifically through standardized data collection, data analysis and decision support. Focus should also shift to the process of obtaining the data specifically into development of patient indexes, form redesign and a service-based policy for form distribution. These goals are achievable in a relatively short time period, yet will create an immediate impact.

In order to complete the information systems strategy a vision for the long-term must also be developed, with the goal being realization of electronic patient records. Implementation would require planning in regards to networking, hardware, software,



data security, patient and user needs, however as an early adapter of such a system funding opportunities may be available to offset the financial obligation.

In essence, the RHA-Central is existing in a data rich environment, however strategies must be implemented to ensure that the data is collected and submitted in a standardized way. In so doing, the data becomes a competitive advantage for the RHA providing it with the evidence necessary to support decisions. Methods of standardization would be best leveraged in an electronic format, and moving the information systems towards true electronic capture in the form of an electronic patient record would provide the greatest return to the organization in fulfilling the needs of patients, care providers and administration.

# Knowledge Transfer

This project is the synthesis of the education provided in the Master of Science in Information Systems (MSIS) degree program. The Regional Health Authority – Central Inc required an analysis of the current systems and a vision for the future. In order to successfully achieve their goals it was necessary to understand the current system, and evaluate how that system is serving the RHA –Central. From analyzing the current system, it was then necessary to determine what would be considered best practice in terms of information systems in a healthcare environment in Canada. Finally it was necessary to amalgamate this information and determine the ways in which it could fit into the current information environment while moving the organization forward. Each of these steps combined a number of the coursework elements required in completion of the MSIS program.

In developing the project concept, it was important to utilize the skills that were taught in the project management course. This included meeting with key project stakeholders, identifying the objectives of the work, determining the scope, in combination with a project timeline. The preparation process allowed for the plan to be developed and approved, and the project to commence. Project management tools were essential to the success keeping it both ahead of schedule, and setting reasonable deadlines for deliverables. Due to planning, the project met both the organizational goals, and exceeded expectations in terms of deliverables and recommendations.

Although project management was an underlying factor to the successful completion of the project, the core of the project relied on the knowledge of information systems. It was particularly important to understand how the current system was

implemented. In relation to the Boundary Trails system it was essential to understand database design, as well as telecommunications networks. The problems that were associated with the system involved the inability to do information retrieval in an ad hoc methodology. Due to the work experience that I have accumulated, this problem is inherent among healthcare information systems; due to the complexity of healthcare the clinical information systems are often large with unwieldy databases. The combination of hundreds of tables, the associated look-up tables, and a lack of indexes quickly indicated there were issues with database design that was limiting in regards to information retrieval. It was also important to understand networks, specifically in relation to why the current network was failing multiple times per week. This combined with high fail over times illustrated another issue that needs to be addressed by the organization. The topology and configuration of the current network specifically in regards to the location limitations, a lack of redundancy, and a limited emergency/disaster plan were all issues that were covered in our telecommunications coursework. In evaluating the current system, it was important to clearly express the issues that existed, specifically relating to systems analysis and design. It was important to be able to aggregate the problems to a level that could be understood by management, while being expressive enough to be understood by the information systems personnel. This portion of the project focused on the development of so-called "soft skills", that are necessary to clearly articulate across the functional areas within the RHA-Central.

The remainder of the coursework completed in the MSIS program, was essential to creating a concise strategy that addressed the current problems in the system, while also looking to the future. In order to do this, it was important to draw on the critical

analysis and visionary skills that were developed in the information strategy and policy class. This class illustrated the need to understand what the industry as a whole is doing, and how that compares to your own strategy. It was this analysis that clearly illustrated some strategic trends in the healthcare industry. This literature review also helped to distinguish that there are few leaders in information technology in healthcare. Therefore, it identified the need for internal resources that would have the skills necessary to create and most importantly to maintain an improved information environment. After identification of the strategies that could be used to progress the systems it was necessary to provide more concrete descriptions that laid out how each of these interventions could be achieved. In order to do so it was necessary to be able to describe the concepts of databases, information retrieval, networking, and personnel requirements.

Prior to the MSIS program, these concepts were foreign to myself as well, as I was coming from a business background. Therefore, when looking at the conclusions of this project, the influence of the MSIS program is integral to the findings. I found this project allowed for a marriage between my business background, work experience in healthcare, and most essential an advanced understanding of information systems. I feel that I was able to effectively transfer and translate the knowledge acquired in the classroom to a real world situation.

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# **Appendix A**

## **Boundary Trails Health Centre**

## Data Dictionary: Boundary Trails Health Centre

<b>Variable:</b>	Case Name
<b>Alias:</b>	CASE NAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	emergency

<b>Variable:</b>	Date
<b>Alias:</b>	DATE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-01-1999 to Current date

<b>Variable:</b>	Case ID
<b>Alias:</b>	CASE ID No.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Auto Numeric

<b>Variable:</b>	Health Record Number
<b>Alias:</b>	Health Record Number
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Retrieved based on patient information

<b>Variable:</b>	Surname
<b>Alias:</b>	PATIENT SURNAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As per birth certificate



<b>Variable:</b>	First Name
<b>Alias:</b>	PATIENT'S FIRST NAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As per birth certificate

<b>Variable:</b>	Address
<b>Alias:</b>	
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	City
<b>Alias:</b>	
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Province/State
<b>Alias:</b>	
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Postal Code / Zip Code
<b>Alias:</b>	
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Telephone Number
<b>Alias:</b>	TELEPHONE –HOME NO.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Previous Name
<b>Alias:</b>	PREVIOUS NAME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Manitoba Health Number
<b>Alias:</b>	MHSC #
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient MHSC card

<b>Variable:</b>	Personal Health Identification Number
<b>Alias:</b>	P.H.I.N.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient MHSC card

<b>Variable:</b>	Date of Birth
<b>Alias:</b>	D.O.B.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Age
<b>Alias:</b>	AGE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Sex
<b>Alias:</b>	SEX
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Male Female Unknown/Other

<b>Variable:</b>	Religion
<b>Alias:</b>	RELIGION
<b>Status:</b>	optional
<b>Acceptable Values:</b>	If volunteered by patient

<b>Variable:</b>	Emergency Contact
<b>Alias:</b>	Emergency Contact
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Relationship
<b>Alias:</b>	RELATIONSHIP
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Emergency Telephone Number
<b>Alias:</b>	TELEPHONE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Registrant Name
<b>Alias:</b>	REGISTRANT NAME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Registrant Employer
<b>Alias:</b>	REGISTRANT EMPLOYER
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Patient's Employer
<b>Alias:</b>	PATIENT'S EMPLOYER
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Employer Address
<b>Alias:</b>	ADDRESS
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Accident Date time
<b>Alias:</b>	ACCIDENT DATETIME
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Accident Location
<b>Alias:</b>	ACCIDENT LOCATION
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	1-HOME 2-WORKPLACE 3-TRAFFIC 4-OTHER 5-HOSPITAL 6-FARM

<b>Variable:</b>	External Cause
<b>Alias:</b>	EXTERNAL CAUSE
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	As provided and/or confirmed by patient

<b>Variable:</b>	Arrival Date time
<b>Alias:</b>	ARRIVAL DATETIME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Auto date time stamp

<b>Variable:</b>	Transport
<b>Alias:</b>	TRANSPORT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Stretcher Wheelchair Carried Walked

<b>Variable:</b>	Brought In By
<b>Alias:</b>	BROUGHT IN BY
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Referral Source
<b>Alias:</b>	REFERRAL SOURCE
<b>Status:</b>	optional
<b>Acceptable Values:</b>	

<b>Variable:</b>	Last Visit Date
<b>Alias:</b>	LAST VISIT DATE
<b>Status:</b>	optional: provided if prior visit indicated
<b>Acceptable Values:</b>	01-01-1999 to Current date

<b>Variable:</b>	Visit Reason
<b>Alias:</b>	VISIT REASON
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As described by patient

<b>Variable:</b>	Medical Alerts
<b>Alias:</b>	ALERTS
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	

<b>Variable:</b>	Allergies
<b>Alias:</b>	ALLERGIES
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	

<b>Variable:</b>	Nursing Assessment Time
<b>Alias:</b>	NURSING ASSESSMENT TIME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM to 11:59 PM OR 0:00 to 23:59

<b>Variable:</b>	Patient Status
<b>Alias:</b>	PATIENT STATUS
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01 – RESUSCITATION 02 – EMERGENT 03 – URGENT 04 – LESS URGENT 05 – NON-URGENT 06 – SCHEDULED

<b>Variable:</b>	Attending Physician
<b>Alias:</b>	ATTENDING PHYSICIAN
<b>Status:</b>	optional
<b>Acceptable Values:</b>	

<b>Variable:</b>	Family Physician
<b>Alias:</b>	FAMILY PHYSICIAN
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

*The following variables are associated with a date and time if the value selected is Yes:*

<b>Variable:</b>	Holding
<b>Alias:</b>	HOLDING
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N If Y: FOR OBSERVATION/FOR ADMISSION

<b>Variable:</b>	Observation
<b>Alias:</b>	OBSERVATION UNIT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Transfer
<b>Alias:</b>	TRANSFERRED TO
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N If Y: Site patient transferred to

<b>Variable:</b>	Admitted
<b>Alias:</b>	ADMITTED
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Sent Home
<b>Alias:</b>	SENT HOME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

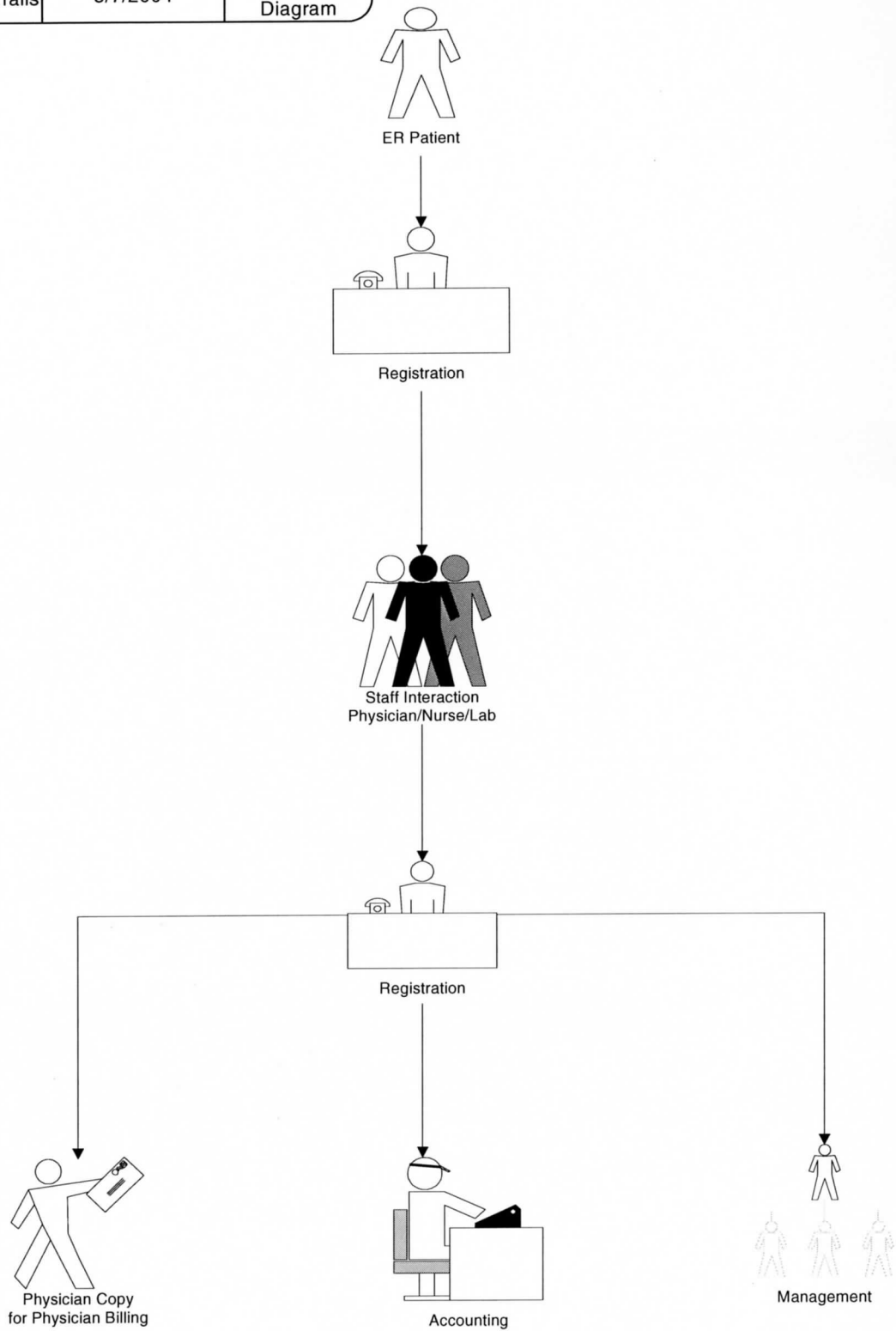
<b>Variable:</b>	Deceased
<b>Alias:</b>	DECEASED
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Autopsy
<b>Alias:</b>	AUTOPSY
<b>Status:</b>	optional: based on deceased status
<b>Acceptable Values:</b>	Y/N



**Figure A-1: Boundary Trails: Patient Flow Diagram**

Regional Health Authority - Central Inc.		
Boundary Trails	5/7/2004	Patient Flow Diagram



**Figure A2: Boundary Trails: Data Flow Diagram**

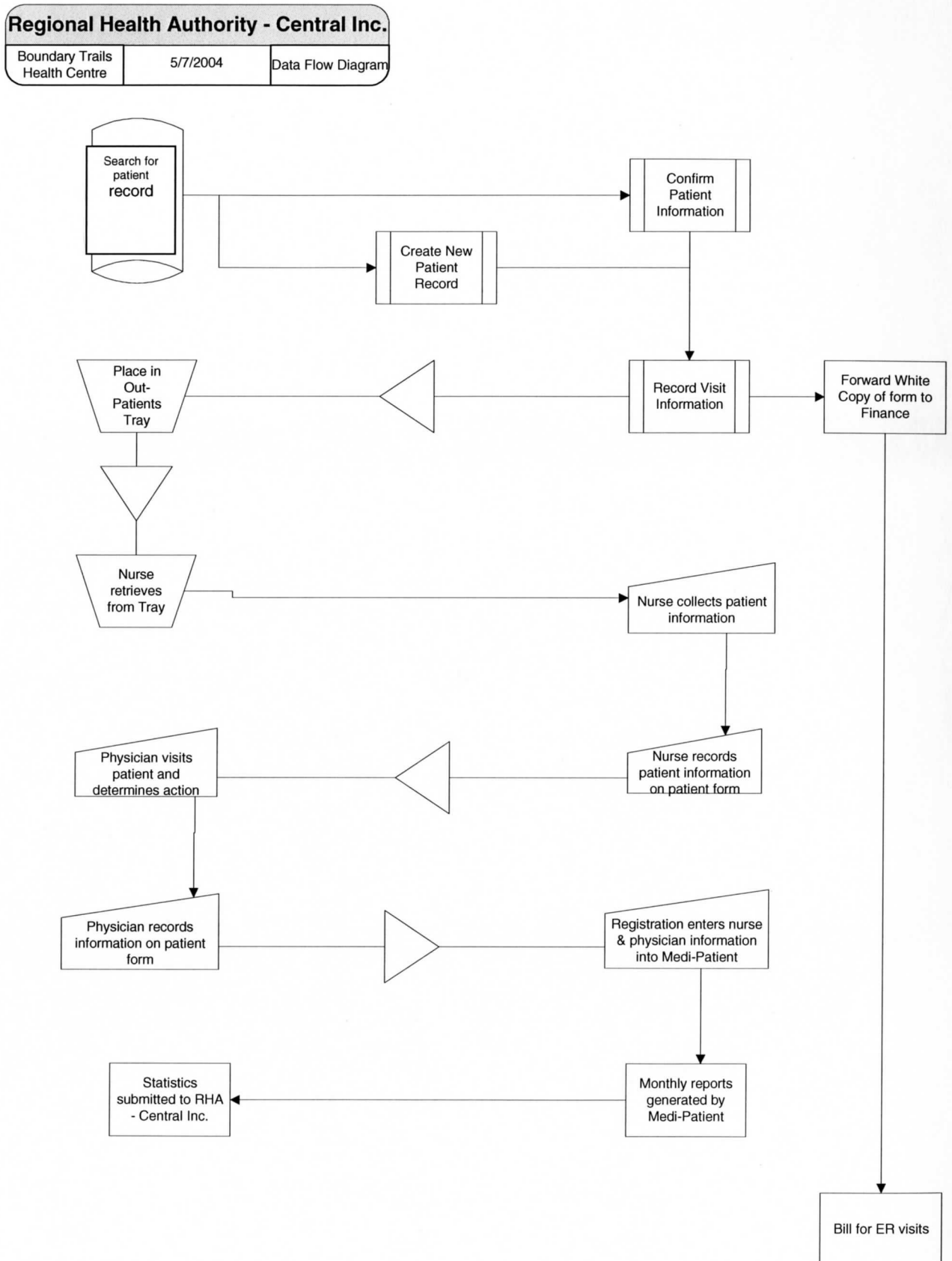


Figure A-3: Boundary Trails: Medi Patient

ME MediPatient+ Client: 64134 - Fuji, Testpatient

ID 64134 Fuji, Testpatient

View Name Type: current

Last Name: fuji First Name: testpatient Middle Name:

Demographics

Vital Status: alive

Gender: male

Birthdate: Aug 06 1997

Marital Status: unknown

Living Arrangement: alone

Preferred Language: english

Religion: unknown

MB PHN:

Family Dr: abbu, g.

Consultant 1:

Consultant 2:

Fax:

Personal Directive: yes

☐ Streptokinase Alert

☒ Flagged Chart

☒ Active Dialysis

☒ MRSA

☒ Blood Refusal

☒ VRE

☒ Active Chemotherapy

Client Group Information

Userfield1:

cancelled  
cancelled  
cancelled  
active  
active  
cancelled  
cancelled  
cancelled  
cancelled  
cancelled

lth c

Expand >> Details...

For Help, press F1. PDGHGATE\medipatient senns

ME MediPatient+ Client: 64134 - Fuji, Testpatient

ID 64134 Fuji, Testpatient

View ID Type: Client ID

ID Value: 64134

Note: This value is assigned by the system and cannot be altered.

Location:

Province: MB

Country: CAN

Postal Code: R0H 0Z0

(204)123-1234

Work Phone: Ext:

(204) -

Other Phone: Ext:

(204) -

Current selection.

☒ Case: 600499 - diagnostic imaging May 17 2004 11:58AM boundary trails health c

Refresh F5 << Collapse Expand >> Details...

For Help, press F1. PDGHGATE\medipatient senns

ME MediPatient+ Client: 64134 - Fuji, Testpatient

ID 64134 Fuji, Testpatient

### New Ambulatory Case

Major Activity: (L34) emergency

Minor Activity: (L5) general emergency

Site: boundary trails health c Attending Dr: abbu, g.

Status: complete Referring Dr:

Start Date: May 28 2004 10:52AM Family Dr: abbu, g.

Referral Source: home Provider Type: physician

Transport: walking Provider:

Urgency:

Discharge Status:

Stop Date: User Field 1:

Mode of Visit: Station/Bed:

Diagnosis Consultation Accident Info. Create New Event

Visit Reason: INJURY Coding Scheme: Free Text

Diagnosis Code:

Ecode:

cancelled  
cancelled  
cancelled  
active  
active  
cancelled  
cancelled  
cancelled  
cancelled  
cancelled  
cancelled

>> Details...

For Help, press F1. PDGHGATE\medipatient senns

ME MediPatient+ Client: 64134 - Fuji, Testpatient

ID 64134 Fuji, Testpatient

### New Ambulatory Case

Major Activity: (L34) emergency

Minor Activity: (L5) general emergency

Site: boundary trails health c Attending Dr: abbu, g.

Status: complete Referring Dr:

Start Date: May 28 2004 10:52AM Family Dr: abbu, g.

Referral Source: home Provider Type: physician

Transport: walking Provider:

Urgency: 4 less ur Nursing Assess. Time: May 28 2004 11:00AM

Discharge Status: discharged Physician Assess. Time: May 28 2004 11:15AM

Stop Date: May 28 2004 11:30AM User Field 1:

Mode of Visit: Station/Bed:

Diagnosis Consultation Accident Info. Create New Event

Visit Reason: INJURY Coding Scheme: Free Text

Diagnosis Code:

Ecode:

cancelled  
cancelled  
cancelled  
active  
active  
cancelled  
cancelled  
cancelled  
cancelled  
cancelled  
cancelled

>> Details...

For Help, press F1. PDGHGATE\medipatient senns

# **Appendix B**

## **Altona Health Centre**

## Data Dictionary: Altona Health Centre

### ***OUT-PATIENT AND EMERGENCY REPORT FORM:***

<b><i>Variable:</i></b>	Hospital Number
<b><i>Alias:</i></b>	HOSP. NO.
<b><i>Status:</i></b>	compulsory
<b><i>Acceptable Values:</i></b>	0102

<b><i>Variable:</i></b>	Manitoba Health Registration Number
<b><i>Alias:</i></b>	M.H. REG. NO.
<b><i>Status:</i></b>	compulsory
<b><i>Acceptable Values:</i></b>	6-digit numeric As assigned by Manitoba Health

<b><i>Variable:</i></b>	Personal Health Identification Number
<b><i>Alias:</i></b>	P.H.I.N.
<b><i>Status:</i></b>	compulsory
<b><i>Acceptable Values:</i></b>	9-digit numeric As assigned by Manitoba Health

<b><i>Variable:</i></b>	Time of Arrival
<b><i>Alias:</i></b>	TIME OF ARRIVAL
<b><i>Status:</i></b>	compulsory
<b><i>Acceptable Values:</i></b>	12:00 AM – 11:59PM OR 0:00-23:59

<b><i>Variable:</i></b>	Brought In By
<b><i>Alias:</i></b>	BROUGHT IN BY
<b><i>Status:</i></b>	optional
<b><i>Acceptable Values:</i></b>	

<b>Variable:</b>	Method of Arrival
<b>Alias:</b>	METHOD OF ARRIVAL
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1-Stretcher 2-Wheelchair 3-Carried 4-Walked

<b>Variable:</b>	Medical Record Number
<b>Alias:</b>	MEDICAL RECORD NO.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Patient-specific medical record number

<b>Variable:</b>	Date of Service- Day
<b>Alias:</b>	DATE OF SERVICE: DAY
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-31

<b>Variable:</b>	Date of Service - Month
<b>Alias:</b>	DATE OF SERVICE: MONTH
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Date of Service - Year
<b>Alias:</b>	DATE OF SERVICE: YEAR
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1880-Current year

<b>Variable:</b>	Title
<b>Alias:</b>	
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Mr. Mrs. Miss. Ms. Rev. Sr.

<b>Variable:</b>	Surname
<b>Alias:</b>	PATIENT'S SURNAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As per birth certificate

<b>Variable:</b>	Given Name
<b>Alias:</b>	GIVEN NAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As per birth certificate

<b>Variable:</b>	Sex
<b>Alias:</b>	SEX
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	M-Male F - Female U - Unknown

<b>Variable:</b>	Date of Birth - Day
<b>Alias:</b>	DATE OF BIRTH: DAY
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-31

<b>Variable:</b>	Date of Birth - Month
<b>Alias:</b>	DATE OF BIRTH: MONTH
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-12



<b>Variable:</b>	Date of Birth - Year
<b>Alias:</b>	DATE OF BIRTH: YEAR
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1880-Current Year

<b>Variable:</b>	Age
<b>Alias:</b>	AGE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Previous Name
<b>Alias:</b>	PREVIOUS NAME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As volunteered by patient

<b>Variable:</b>	Address
<b>Alias:</b>	R.R. GROUP, BOX NO. AND/OR STREET AND NUMBER
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	City
<b>Alias:</b>	CITY, TOWN, VILLAGE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Postal Code
<b>Alias:</b>	MUNICIPALITY/POSTAL CODE
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Telephone Number
<b>Alias:</b>	TELEPHONE NO.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Responsible for Payment
<b>Alias:</b>	RESPONSIBLE FOR PAYMENT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1 – M.H. 2 – GOV'T. CAN 3 – W.C.B. 4 – SELF 5 – OTHER (SPECIFY)

<b>Variable:</b>	Date of Service - Month
<b>Alias:</b>	DATE OF SERVICE: MONTH
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Family Head: Given Name
<b>Alias:</b>	FAMILY HEAD
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Emergency Contact Name
<b>Alias:</b>	NEAREST RELATIVE OR FRIEND
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Emergency Contact Telephone
<b>Alias:</b>	TELEPHONE NO.
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Non-Manitoba Health – Stay Status
<b>Alias:</b>	COMPLETE IF PATIENT NOT REGISTERED WITH M.H.
<b>Status:</b>	optional: based on M.H. status
<b>Acceptable Values:</b>	Temporary Stay Permanent Stay

<b>Variable:</b>	Arrival in Manitoba
<b>Alias:</b>	ARRIVED IN MAN. ON
<b>Status:</b>	optional: based on M.H. status
<b>Acceptable Values:</b>	01-01-1880 – Current date

<b>Variable:</b>	Previous Address
<b>Alias:</b>	PREVIOUS ADDRESS
<b>Status:</b>	optional: based on M.H. status
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Entrance Complaint
<b>Alias:</b>	ENTRANCE COMPLAINT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As described by patient

<b>Variable:</b>	Accident: Time
<b>Alias:</b>	ACCIDENT: TIME
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	As provided by patient 12:00 AM – 11:59 PM OR 0:00 – 23:59

<b>Variable:</b>	Accident: Day
<b>Alias:</b>	ACCIDENT: DAY
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	01-31

<b>Variable:</b>	Accident: Month
<b>Alias:</b>	ACCIDENT: MONTH
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Accident: Year
<b>Alias:</b>	ACCIDENT: YEAR
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	1880-Current year

<b>Variable:</b>	Accident: Location
<b>Alias:</b>	LOCATION
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	1-HOME 2-WORKPLACE 3-TRAFFIC 4-OTHER 5-HOSPITAL 6-FARM

<b>Variable:</b>	External Cause of Injury
<b>Alias:</b>	EXTERNAL CAUSE OF INJURY
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Triage Assessment Form
<b>Alias:</b>	NURSING TRIAGE ASSESSMENT FORM
<b>Status:</b>	optional
<b>Acceptable Values:</b>	Yes No

<b>Variable:</b>	Triage Assessment Time
<b>Alias:</b>	TIME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	12:00AM – 11:59 PM OR 0:00-23:59

<b>Variable:</b>	Family Doctor
<b>Alias:</b>	FAMILY DOCTOR
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Medical Alert
<b>Alias:</b>	MEDICAL ALERT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	

<b>Variable:</b>	Patient Type
<b>Alias:</b>	PATIENT TYPE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01 – RESUSCITATION 02 – EMERGENT 03 – URGENT 04 – LESS URGENT 05 – NON-URGENT 06 - SCHEDULED

<b>Variable:</b>	Attending Doctors
<b>Alias:</b>	ATTENDING DOCTORS
<b>Status:</b>	not currently populated
<b>Acceptable Values:</b>	

<b>Variable:</b>	Attending Doctors: Called
<b>Alias:</b>	CALLED
<b>Status:</b>	not currently populated
<b>Acceptable Values:</b>	12:00 AM – 11:59 PM OR 0:00 – 23:59

<b>Variable:</b>	Attending Doctors: Answered
<b>Alias:</b>	ATTENDING DOCTORS: ANSWERED
<b>Status:</b>	not currently populated
<b>Acceptable Values:</b>	12:00 AM – 11:59 PM OR 0:00-23:59

<b>Variable:</b>	Attending Doctors: Arrived
<b>Alias:</b>	ATTENDING DOCTORS: ARRIVED
<b>Status:</b>	not currently populated
<b>Acceptable Values:</b>	12:00 AM – 11:59 PM OR 0:00-23:59

<b>Variable:</b>	Nursing Assessment Time
<b>Alias:</b>	VITAL SIGNS : TIME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM to 11:59 PM OR 0:00 to 23:59

<b>Variable:</b>	Time of Treatment
<b>Alias:</b>	TIME OF TREATMENT
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM to 11:59 PM OR 0:00 to 23:59

*The following variables are associated with a date and time if the value selected is Yes:*

<b>Variable:</b>	Holding
<b>Alias:</b>	HOLDING
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N If Y: FOR OBSERVATION/FOR ADMISSION

<b>Variable:</b>	Observation
<b>Alias:</b>	OBSERVATION UNIT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Transfer
<b>Alias:</b>	TRANSFERRED TO
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N If Y: Site patient transferred to

<b>Variable:</b>	Admitted
<b>Alias:</b>	ADMITTED
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Sent Home
<b>Alias:</b>	SENT HOME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Deceased
<b>Alias:</b>	DECEASED
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Autopsy
<b>Alias:</b>	AUTOPSY
<b>Status:</b>	optional: based on deceased status
<b>Acceptable Values:</b>	Y/N

## **Patient Log: Altona Health Centre**

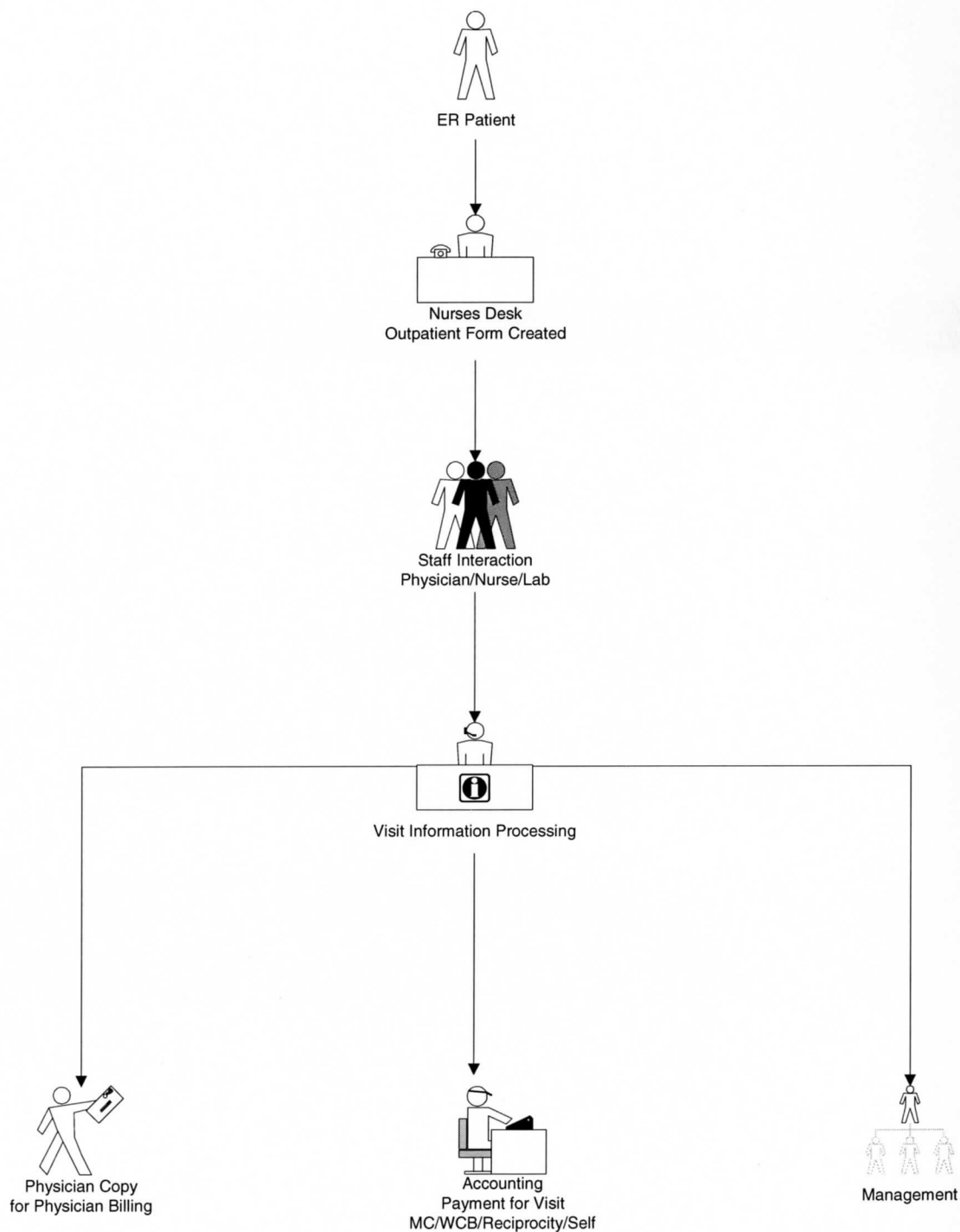
### **Variables collected:**

- **Time**
- **Patient's Name**
- **Shift**
  - **Day** (0800-1559)
  - **Evening** (1600-2400)
  - **Night** (001-0759)
- **Shift of RHA**
  - **Day** (0700-1500)
  - **Evening** (1500-2300)
  - **Night** (2300-0700)
- **Doctor**
- **Medical Record Number**
- **Outpatient Number**
- **Patient Type**
  - **1**
  - **2**
  - **3**
  - **4**
  - **5**
  - **6**
  - **7**
- **Observation**
- **Inpatient**
- **DOA**
- **Transferred**
- **Waiting Time**



**Figure B1: Altona :Patient Flow Diagram**

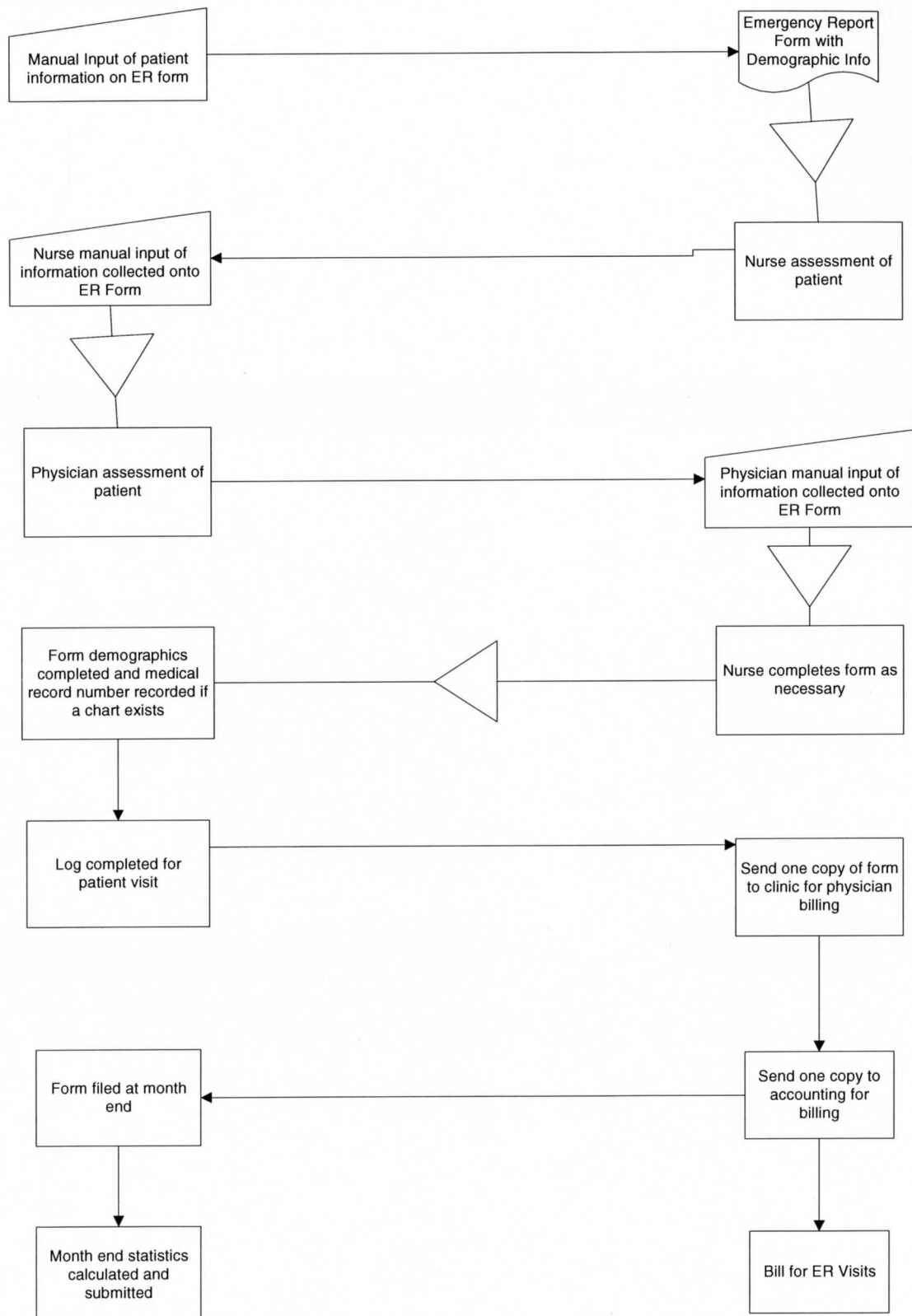
Regional Health Authority - Central Inc.		
Altona Health Centre	5/21/2004	Patient Flow Diagram



**Figure B2:Altona: Data Flow Diagram**

**Regional Health Authority - Central Inc.**

Altona Health Centre	5/21/2004	Data Flow Diagram
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# **Appendix C**

## **Rock Lake Hospital**

## Data Dictionary: Rock Lake Hospital

### ***OUT-PATIENT AND EMERGENCY REPORT FORM:***

<b><i>Variable:</i></b>	Hospital Number
<b><i>Alias:</i></b>	HOSP. NO.
<b><i>Status:</i></b>	Compulsory
<b><i>Acceptable Values:</i></b>	0119

<b><i>Variable:</i></b>	Manitoba Health Registration Number
<b><i>Alias:</i></b>	M.H. REG. NO.
<b><i>Status:</i></b>	Compulsory
<b><i>Acceptable Values:</i></b>	6-digit numeric As assigned by Manitoba Health

<b><i>Variable:</i></b>	Personal Health Identification Number
<b><i>Alias:</i></b>	P.H.I.N.
<b><i>Status:</i></b>	Compulsory
<b><i>Acceptable Values:</i></b>	9-digit numeric As assigned by Manitoba Health

<b><i>Variable:</i></b>	Time of Arrival
<b><i>Alias:</i></b>	TIME OF ARRIVAL
<b><i>Status:</i></b>	optional
<b><i>Acceptable Values:</i></b>	12:00 AM – 11:59PM OR 0:00-23:59

<b><i>Variable:</i></b>	Brought In By
<b><i>Alias:</i></b>	BROUGHT IN BY
<b><i>Status:</i></b>	optional
<b><i>Acceptable Values:</i></b>	

<b>Variable:</b>	Method of Arrival
<b>Alias:</b>	METHOD OF ARRIVAL
<b>Status:</b>	optional
<b>Acceptable Values:</b>	1-Stretcher 2-Wheelchair 3-Carried 4-Walked

<b>Variable:</b>	Medical Record Number
<b>Alias:</b>	MEDICAL RECORD NO.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Patient-specific medical record number

<b>Variable:</b>	Date of Service- Day
<b>Alias:</b>	DATE OF SERVICE: DAY
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-31

<b>Variable:</b>	Date of Service - Month
<b>Alias:</b>	DATE OF SERVICE: MONTH
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Date of Service - Year
<b>Alias:</b>	DATE OF SERVICE: YEAR
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1880-Current year

<b>Variable:</b>	Title
<b>Alias:</b>	
<b>Status:</b>	optional
<b>Acceptable Values:</b>	Mr. Mrs. Miss. Ms. Rev. Sr.

<b>Variable:</b>	Surname
<b>Alias:</b>	PATIENT'S SURNAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As per birth certificate

<b>Variable:</b>	Given Name
<b>Alias:</b>	GIVEN NAME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As per birth certificate

<b>Variable:</b>	Sex
<b>Alias:</b>	SEX
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	M-Male F - Female U - Unknown

<b>Variable:</b>	Date of Birth - Day
<b>Alias:</b>	DATE OF BIRTH: DAY
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-31

<b>Variable:</b>	Date of Birth - Month
<b>Alias:</b>	DATE OF BIRTH: MONTH
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Date of Birth - Year
<b>Alias:</b>	DATE OF BIRTH: YEAR
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1880-Current Year

<b>Variable:</b>	Age
<b>Alias:</b>	AGE
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Previous Name
<b>Alias:</b>	PREVIOUS NAME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As volunteered by patient

<b>Variable:</b>	Address
<b>Alias:</b>	R.R. GROUP, BOX NO. AND/OR STREET AND NUMBER
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	City
<b>Alias:</b>	CITY, TOWN, VILLAGE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Postal Code
<b>Alias:</b>	MUNICIPALITY/POSTAL CODE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Telephone Number
<b>Alias:</b>	TELEPHONE NO.
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Responsible for Payment
<b>Alias:</b>	RESPONSIBLE FOR PAYMENT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	1 – M.H. 2 – GOV'T. CAN 3 – W.C.B. 4 – SELF 5 – OTHER (SPECIFY)

<b>Variable:</b>	Date of Service - Month
<b>Alias:</b>	DATE OF SERVICE: MONTH
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Family Head
<b>Alias:</b>	FAMILY HEAD
<b>Status:</b>	not currently populated
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Emergency Contact Name
<b>Alias:</b>	NEAREST RELATIVE OR FRIEND
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Emergency Contact Telephone
<b>Alias:</b>	TELEPHONE NO.
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient



<b>Variable:</b>	Non-Manitoba Health – Stay Status
<b>Alias:</b>	COMPLETE IF PATIENT NOT REGISTERED WITH M.H.
<b>Status:</b>	optional: based on M.H. status
<b>Acceptable Values:</b>	Temporary Stay Permanent Stay

<b>Variable:</b>	Arrival in Manitoba
<b>Alias:</b>	ARRIVED IN MAN. ON
<b>Status:</b>	optional: based on M.H. status
<b>Acceptable Values:</b>	01-01-1880 – Current date

<b>Variable:</b>	Previous Address
<b>Alias:</b>	PREVIOUS ADDRESS
<b>Status:</b>	optional: based on M.H. status
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Entrance Complaint
<b>Alias:</b>	ENTRANCE COMPLAINT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	As described by patient

<b>Variable:</b>	Accident: Time
<b>Alias:</b>	ACCIDENT: TIME
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	As provided by patient 12:00 AM – 11:59 PM OR 0:00 – 23:59

<b>Variable:</b>	Accident: Day
<b>Alias:</b>	ACCIDENT: DAY
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	01-31

<b>Variable:</b>	Accident: Month
<b>Alias:</b>	ACCIDENT: MONTH
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	01-12

<b>Variable:</b>	Accident: Year
<b>Alias:</b>	ACCIDENT: YEAR
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	1880-Current year

<b>Variable:</b>	Accident: Location
<b>Alias:</b>	LOCATION
<b>Status:</b>	optional: based on accident status
<b>Acceptable Values:</b>	1-HOME 2-WORKPLACE 3-TRAFFIC 4-OTHER 5-HOSPITAL 6-FARM

<b>Variable:</b>	External Cause of Injury
<b>Alias:</b>	EXTERNAL CAUSE OF INJURY
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Triage Assessment Form
<b>Alias:</b>	NURSING TRIAGE ASSESSMENT FORM
<b>Status:</b>	optional
<b>Acceptable Values:</b>	Yes No

<b>Variable:</b>	Family Doctor
<b>Alias:</b>	FAMILY DOCTOR
<b>Status:</b>	optional
<b>Acceptable Values:</b>	As provided by patient

<b>Variable:</b>	Medical Alert
<b>Alias:</b>	MEDICAL ALERT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	

<b>Variable:</b>	Patient Type
<b>Alias:</b>	PATIENT TYPE
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	01 – RESUSCITATION 02 – EMERGENT 03 – URGENT 04 – LESS URGENT 05 – NON-URGENT 06 - SCHEDULED

<b>Variable:</b>	Attending Doctors
<b>Alias:</b>	ATTENDING DOCTORS
<b>Status:</b>	optional
<b>Acceptable Values:</b>	

<b>Variable:</b>	Attending Doctors: Called
<b>Alias:</b>	CALLED
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM – 11:59 PM OR 0:00 – 23:59

<b>Variable:</b>	Attending Doctors: Answered
<b>Alias:</b>	ATTENDING DOCTORS: ANSWERED
<b>Status:</b>	not currently populated
<b>Acceptable Values:</b>	12:00 AM – 11:59 PM OR 0:00-23:59

<b>Variable:</b>	Attending Doctors: Arrived
<b>Alias:</b>	ATTENDING DOCTORS: ARRIVED
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM – 11:59 PM OR 0:00-23:59

<b>Variable:</b>	Nursing Assessment Time
<b>Alias:</b>	VITAL SIGNS : TIME
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM to 11:59 PM OR 0:00 to 23:59

<b>Variable:</b>	Time of Treatment
<b>Alias:</b>	TIME OF TREATMENT
<b>Status:</b>	optional
<b>Acceptable Values:</b>	12:00 AM to 11:59 PM OR 0:00 to 23:59

*The following variables are associated with a date and time if the value selected is Yes:*

<b>Variable:</b>	Holding
<b>Alias:</b>	HOLDING
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N If Y: FOR OBSERVATION/FOR ADMISSION

<b>Variable:</b>	Observation
<b>Alias:</b>	OBSERVATION UNIT
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Transfer
<b>Alias:</b>	TRANSFERRED TO
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N If Y: Site patient transferred to

<b>Variable:</b>	Admitted
<b>Alias:</b>	ADMITTED
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Sent Home
<b>Alias:</b>	SENT HOME
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

<b>Variable:</b>	Deceased
<b>Alias:</b>	DECEASED
<b>Status:</b>	compulsory
<b>Acceptable Values:</b>	Y/N

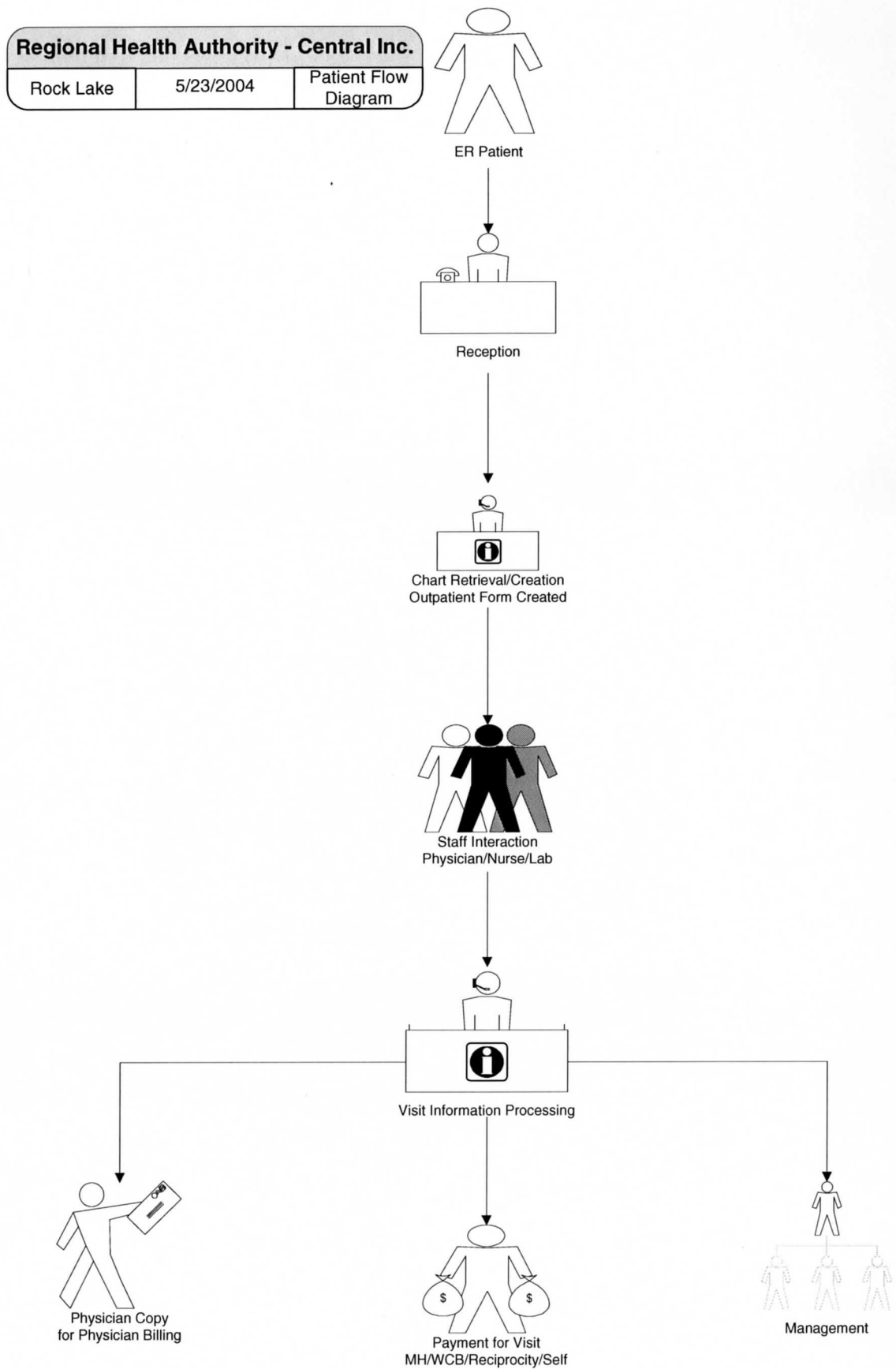
<b>Variable:</b>	Autopsy
<b>Alias:</b>	AUTOPSY
<b>Status:</b>	optional: based on deceased status
<b>Acceptable Values:</b>	Y/N

## **Patient Log: Rock Lake Hospital**

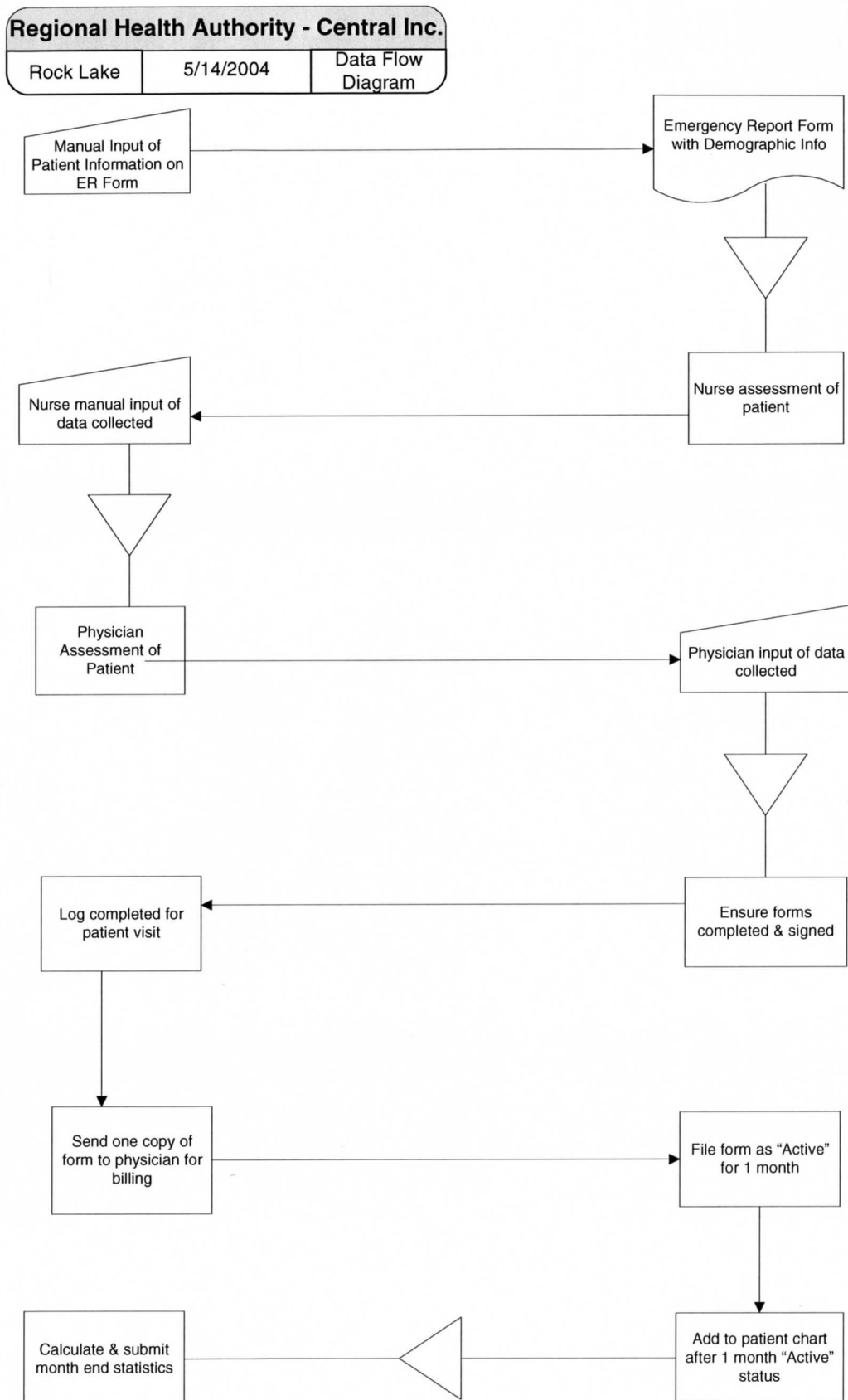
### **Variables Collected:**

- **Log #**
- **Name**
- **Surgery (Y/N)**
- **Patient Type**
  - **1**
  - **2**
  - **3**
  - **4**
  - **5**
  - **6**
  - **+**
- **Shift**
  - **Day**
  - **Evening**
  - **Night**
- **Date**
- **Doctor**
- **Waiting Time**
- **Triage (Y/N)**
- **Disposition**
  - **Admitted**
  - **Transferred**
  - **WCB**
  - **Reciprocal**
- **Medical Record Number**

**Figure C1: Rock Lake: Patient Flow Diagram**



**Figure C2: Rock Lake: Data Flow Diagram**







D-C-1

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