

# **IMPROVING QUALITY OF PATIENT INFORMATION**

By

Fahim Alex Haroon  
B00456764  
haroon@cs.dal.ca

Performed at the Slic Laser Clinic,  
33, Cobequid Road, Lower Sackville  
Nova Scotia, Canada  
B4C2W5

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Fahim Alex Haroon

## EXECUTIVE SUMMARY

The level of data to process and the need of up-to-date data for quick analysis and decision-making are vital to retain its present position and growth in the industry. Hence, the Slic Laser decided to computerize their clinic through **Electronic Patient Record (EPR)**.

To find the existing status and system requirement for Slick Laser Clinic the author spend most of his time with clinic technicians, doctors and patients. The author also made a number of visits to their Head Office and had lot of discussions with the Managers and Technicians related to different activities. The author is trying to characterize his findings, which are:

- ⊕ The clinic is in need of automation, in all departments with full integration for quick decision-making and increase efficiency.
- ⊕ Presently, the clinic has few software developed by its own employees has very poor value in today's integrated concepts. This software covers few areas of data storage only. The rest of the jobs are done in manually with chances of error.
- ⊕ Electronic Patient Record software has been recommended to capture various patient data with Ad-hoc report capability by which the clinicians will be able to generate various reports for data analysis.
- ⊕ A back-up mass storage hard-drive needs to be put into place which will serve dual purpose. In case of any loss in primary hard-drive, back-up hard-drive will be used to retrieve lost data. In addition the clinicians will be able to perform data-mining in the future on this mass storage hard-drive.
- ⊕ Upon initial negotiations, the implementation of the demo system is scheduled in the summer of 2007 which will be further enhanced in the near future.

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## **1.0 INTRODUCTION**

### **1.1 MY PROJECT AT SLICK LASER CLINIC**

Only theoretical orientations cannot make one suitable in the real life situation. Keeping in view acquiring practical knowledge, each student of Health Informatics program, Dalhousie University, Canada is required to do either thesis or internship with an organization.



This report was undertaken as a part of the Master of Health Informatics program and has been prepared in compliance with the instructions of Health Informatics Internship guideline, Dalhousie University, Canada. As an intern the author was assigned “to improve the quality of patient information” by applying health informatics knowledge.

### **1.2 BACKGROUND**

We are now living in the era of Information Technology. With the help of Information Technology we are able to perform our daily tasks more easily and efficiently. It is not only offices that are going paperless to automate systems but also the healthcare industry. One of the major goals of healthcare is to modernize the health information systems. Now it is more likely that our health information cannot be shared instantly with other health professionals in the current system. But with the help of Information Technology tools and software such as Electronic Patient Records and small portable computers this is beginning to change. As Health Informaticians we need to play a bigger role to make such changes. We are limiting ourselves by not taking the advantages what new technology has to offer.

## **2.0 DESCRIPTION OF THE ORGANIZATION**

Every successful organization is a reflection of dedicated teamwork, decentralization, delegation of authority and being quality conscious. Slic Laser Clinic won the ‘Business of the year’ award in 2005 by the Halifax Chamber of Commerce. It is located at Sackville, Nova Scotia. The clinic provides various services like

-  Microdermabrasion
-  Hair removal

- ✚ Scar and stretch mark reduction
- ✚ Pigmented lesions
- ✚ Vascular lesions
- ✚ Vein removal
- ✚ Age and sun spots
- ✚ Finer lines and wrinkles

The clinic has recently replaced its LightSheer Diode laser system with state-of-the-art Apogee Elite™ two in one laser system. By providing two different wavelengths, the Apogee Elite laser can be used to treat patients with all types of skin. The laser can be applied to perform various treatments e.g. hair removal, vein removal etc. The Apogee Elite emits a beam of light that heats the target area (i.e. follicle or vein). The light energy damages the target, while sparing the surrounding skin. After a period of time, a reaction will occur (i.e. the follicle will exfoliate, or the blemish will slowly and naturally disappear). The Apogee Elite delivers high fluences from large spot sizes ensuring faster, wider surface coverage and more effective treatment. The Apogee Elite laser also is integrated with Smart Cool system by Cynosure. This system utilizes a "double cooling" technique which uses the body's natural cooling process in conjunction with a specifically engineered external cooling system during the treatment which minimizes patient discomfort.

Laser technology has become an important factor in the treatment of vascular deformities such as hemangiomas, port wine stains, varicose veins and spider veins. Laser surgery sends very strong bursts of light onto the vein. Nd:YAG laser light penetrates deeply into tissue and can be used for the coagulation of unwanted veins this can makes the vein slowly fade and disappear. It takes several months after the laser treatment to notice improvement and often additional vein treatments are require.

US Department of Health and Human Services have published that Laser surgery is more appealing to some patients because it does not use needles or incisions and it is less

painful. New technology in laser treatments can effectively treat spider veins in the legs. Lasers are very direct and accurate than other current methods of skin or eye treatment.

Backed by long-term clinical data, Apogee Elite system currently used by Slick Laser clinic has proven to be safe with minimum side-effect.

### **3.0 DISCUSSION**

Internship is a focus to reality, which takes us from the world of abstract theory to concrete reality. It is a work experience that is either directly related to the major field of study or career interest of student in college or University. It is a practical experience of theoretically gained knowledge. It can be considered as a preliminary trial to be acquainted with any organization and to make oneself confident enough to enter into service life and start building carrier. The internship course is worth six credit hours. The requirement is that the student must work full-time in the respective organization for at least 13 weeks and then submit an internship report to outline the activities carried out during the internship period.

### **3.1 LITERATURE REVIEW**

During the internship period, the author has done extensive research on different kinds of technologies that can be applied to develop the electronic patient record (EPR). After comparing the pros and cons of various technologies, the author has chosen to develop web-based EPR using the PHP coding for the front-end and MySQL for the back-end.

The author claims that web-technologies have certain advantages over other technologies and by using web-based EPR the clinic will significantly improve patient care. The author has researched various articles in order to support his claim. In Finland, the shared health record is a virtual electronic health record (EHR). It consists of health data generated, maintained and preserved by different health care service providers. In the virtual workspace multi-professional teams and patients collaborate and share information regardless of time and place. The original data including images can be viewed with a web browser. [3] In Italy at the School of Veterinary Medicine, University of Milan, they have developed electronic patient record, compliant with the IT standards

HL7, DICOM and IHE. Their goal was to improve the efficiency of veterinary hospital workflows, making the stored clinical data more homogenous and sharable, thereby increasing the integration with current and future software applications. They have developed their application based on client-server architecture and web-oriented technology to maximize data sharing. In the front-end, the PHP scripting language was used and MySQL DBMS for the back-end. After testing the system from May to October 2006, the majority of the veterinarians involved in the test agreed on the advantages obtained by the use of this application. The results show some major improvement in many sectors of the hospital activities for example concerning the availability of all the useful clinical data [71.4%], the quality of the diagnostic procedures [78.58%] and the efficiency [85.58%] of hospital activities. [4]

By studying different technology, it has helped the author to choose the appropriate technology to design the electronic patient record. The author has agreed with other researchers that web-based applications can certainly be applied to health care system to deliver better patient care.

### **3.2 WORK PERFORMED BY THE INTERN**

The author has used the System Approach. There are two major activities in the system approach that the author has followed; they are system analysis and design. Under the system analysis the author has studied the existing manual system and its environment.

The purpose of the analysis was to:

- ⊕ Understand the components and functions of the current system
- ⊕ Identify the organization's information and processing needs
- ⊕ Determining the characteristics of the new system to meet these needs

The purpose of the system design was to:

- ⊕ Specify the components and functions of electronic patient record (EPR) that is most efficient and effective in meeting the organization's information needs.



Sources of Data: The primary source of data was face-to-face communication with the employees of all departments.

The main sources of secondary data are

- ⊕ Interview
- ⊕ Collection of reports
- ⊕ Observation
- ⊕ User view collection

### **3.3 EXISTING SYSTEM**

At present, the company is doing manual process for any decision-making. When a patient arrives, the attending clinician takes notes manually. When a patient visit for the next time, the clinicians has to go through all the paper work manually again and search through documents to retrieve the existing patient data.

#### **3.3.1 ARCHITECTURE OF THE EXISTING SYSTEM**

Internally, age-old systems developed in MS Access are being partially used in storing patient's basic demographic information and rest of the clinical data is paper based. Current system is not integrated or updateable and has very poor facilities. So, the decision-makers in any level are always taking the manually processed data for their activities. These data preparation from the papers manually is time consuming, inefficient and as well as costly. There are also possibilities of human error & losing valuable data.

### **3.4 RECOMMENDATION FOR A PROPOSED SYSTEM**

Based on the description presented above about the existing system of the company we are hereby trying to make a brief discussion of the proposed system. To improve the above circumstances, the clinic should go for integrated system of software in all departments. The related departmental data will be interlinked so that any changes can be reflected in other fields immediately and the clinicians as well as the management can take decision by taking most recent data. Since the clinic will eliminate the chances of manual processing time of their employees, the management will be able to utilize the clinicians in other activities. Efficiency will increase and it will significantly reduce cost

for the clinic. These will come indirectly when the employees or clinicians will be able to work more by eliminating present manual processing.

Through the efficiency improvement and reduction in indirect cost, the clinic will be able to mobilize their workforce in more disciplined manner to expand service and business. At least the clinic will be ensured that every of its decisions are taken with updated data.

*So, the clinic should change their existing system to a fully computerized one as mentioned henceforth.*

### **3.4.1 OBJECTIVES OF OUR ELECTRONIC PATIENT RECORD SYSTEM**

"Digital patient-care records provide a more comprehensive view of pre-hospital care than paper documentation ever could. Reports that used to take months to compile can now be generated in minutes. This will assist in developing enhanced procedures and practices for the entire province," said Scott Campbell, CEO of Medusa Medical Technologies Inc. Hence Medusa technology is developing electronic patient record for the ambulance system. [1]

The author shares the same view as mentioned in this article that practices should ensure the accuracy and completeness of data, as the realization of any benefits from the system is dependent on the quality of data that can be extracted from the system. [2]

Having the above situation in mind, the proposal for this EPR application has the following objectives:

- ⊕ Ability to provide more quality healthcare.
- ⊕ More and better access to patient information by providing clinicians with secure access to information about their patients held on remote disparate computer system.
- ⊕ To provide access control framework, essential to the control and tracking of user and system access, for the purpose of data safety.

- ⊕ To share information by giving multiple users access to the system with specific contents and history feedback related to that department to improve efficiency.
- ⊕ Ability to generate various reports for data analysis.
- ⊕ To achieve this using a thin-client, web-based in a multi-tier architecture that allows for rapid scalability on the server-side and reduces the client configuration to almost zero.

## **4.0 DEVELOPING INFORMATICS SOLUTION:**

### **4.1 GOAL OF THE SYSTEM**

An Electronic Patient Record system which is being currently designed & developed is to provide physicians with greater flexibility in how they maintain and access medical records while improving patient care, reducing medical error and saving significant amounts of time and money.

The EPR system will consists of three main elements:

- Data storage facilities
- Web-server
- User interface

#### **4.1.1 SCOPE OF THE SYSTEM**

This Electronic Patient Record system is web-based on a renowned Relational Database Management System which can be further enhanced by adding additional modules as required.

### **4.2: IMPLEMENTAION OF THE PROPOSED SYSTEM**

The demo version of the Electronic Patient Record system is menu driven and user friendly. The system consists of five modules: Patient Demographic Information, Patient History (longitudinal record), Test Results, Clinical Process, Treatment Results and Scheduling. These modules are customizable and new modules can be integrated with these existing modules. These integrated modules have many benefits as it enable the gathering and reuse of information entered at admission, during the patient episode and

any subsequent treatment. It has role-based security features that allows user to have either full access or limited access to all resources and functions. These options are specified through simple procedures and may be easily modified by the system administrator. Currently the system requires low maintenance and has been optimized to consume low resources. A tutorial has been designed for existing and future user to understand its functions and operability.

The standard file maintenance functions of add, update, delete, required field check, inquire query, print, compressed-listing print, as well as popular integrated database features such as mass-change, mass-delete, on-demand report which can capture data from different forms has been incorporated into the system. Also free-form text and scanned attachment functionality is provided, allowing text and /or images to attached to data records throughout the system. Report are available in printed or on-screen form.

Reports may also be faxed or achieved for future analysis. Each of these features contributes to convenient access to pertinent information.

#### **4.2.1 HIGHLIGHTS OF THE EPR FUNCTIONALITY**

- a. Coded and free-text Clinical data capture with add, delete, update options.
- b. Structured clinical messaging.
- c. Easy search for patients by name and/or date of birth or patient ID.
- d. Online patient data available at every point in the care process and accessible across all departments.
- e. Attaching image file capability.
- f. Fax integration.
- g. User-defined preferences and arrangements of predefined information such as vital signs and prescriptions.
- h. Enforced 128 bit Secure Socket Layer (SSL) encryption for all Internet based access.
- i. Check the status of pending test results
- j. Highlights abnormal results for quick assessment.
- k. Produce cumulative reports in numerical or graphical format.

## **5.0 LIMITATIONS**

Now a day's the Relational Database or Object Oriented System is employed to develop software for its flexibility and new features. So far the author has used relational database with web-base technology. Because of the time limitation and budget constrain of the clinic the author was unable to incorporate all the desired modules into Electronic Patient Record.

## **6.0 CONCLUSION**

This report has presented a web-based Electronic Patient Record (EPR) that has the potential to improve the quality of health data which will lead to better decision making. During the internship the author has spend hours and hours to gather the existing needs of Slick Laser Clinic. The author acknowledged that the information retrieval is not being used as effectively and traditional data gathering by paper are not sufficient when modern software applications can be employed by this clinic to improve patient care. The author has applied his depth health informatics skills to develop the demo version of web-based EPR. One of the main advantages of using web-base EPR is that the patient record itself need not to be physically located in one place, but may be virtual. Patient data stored in multiple, dispersed systems can be captured, processed, communicated, secured, and presented, by giving clinicians fast access to up-to-date and accurate data thereby providing meaningful information and contributing to the knowledge of authorized users for legitimate health care purposes. Without them other latest technologies such as decision support systems cannot be effectively integrated into routine clinical workflow. The availability of complete patient data from a single source, allows better patient care, improves decision making and saves time for clinicians.

The author concludes that web-base and mobile electronic patient record will have a great impact in improving health care in the future and the technology seems very promising. It has been learned that Nova Scotia will be the first province in Canada to offer all of its residents the benefits of electronic patient records throughout the ambulance system by January 2008. [1] In a transform healthcare system, the technologies themselves, as well as their deployment, are challenging matter. So, enabling healthcare provider to

modernize and grow their enterprise clinical IT deployment while cutting costs and improving the quality of healthcare delivery will be a challenge for the future.

## **7.0 RECOMMENDATIONS**

In the future the author would like to see the system be fully integrated with Electronic Health Record system with more enhanced security future. When enough data are gathered over time, the Clinicians and IT experts will be able to use data-mining technology (the extraction of hidden predictive information from large databases) to analyze patient's results which will allow to make proactive, knowledge driven decisions. The clinic should hire health informatics expert to make the system HL7-compliant and make it ready for exchanging information with national infrastructure of Electronic Health Record which is currently under implementation by Health Infoway. Optimal use of Electronic Patient Record on clinics or hospitals depends upon the availability of the patient record at the point of care, i.e. at the treatment room, operation theatre etc. Typically, healthcare professionals are in constant movement and some tasks are performed for different patients and at different physical places. In order to preserve this dynamic performance when introducing EPR, the cutting-edge technology can be used to interchange EPR data to Mobile Patient Record (MPR) and handheld equipment only then the EPR solutions will be more complete and better tool by using mobile equipment. To keep in mind the future expandability scope, as the clinic is rapidly growing up and as a result the rules and procedure would be changed, to keep track with changing needs constant updates are required.

## 8.0 REFERENCES

[1] Government of Nova Scotia, Electronic Patient Records Introduced in Ambulances, Accessed on June 15, 2007 at [www.gov.ns.ca/news/details.asp?id=20070615004](http://www.gov.ns.ca/news/details.asp?id=20070615004)

[2] Electronic Patient Records by Nicki Kahnamoui. 2004

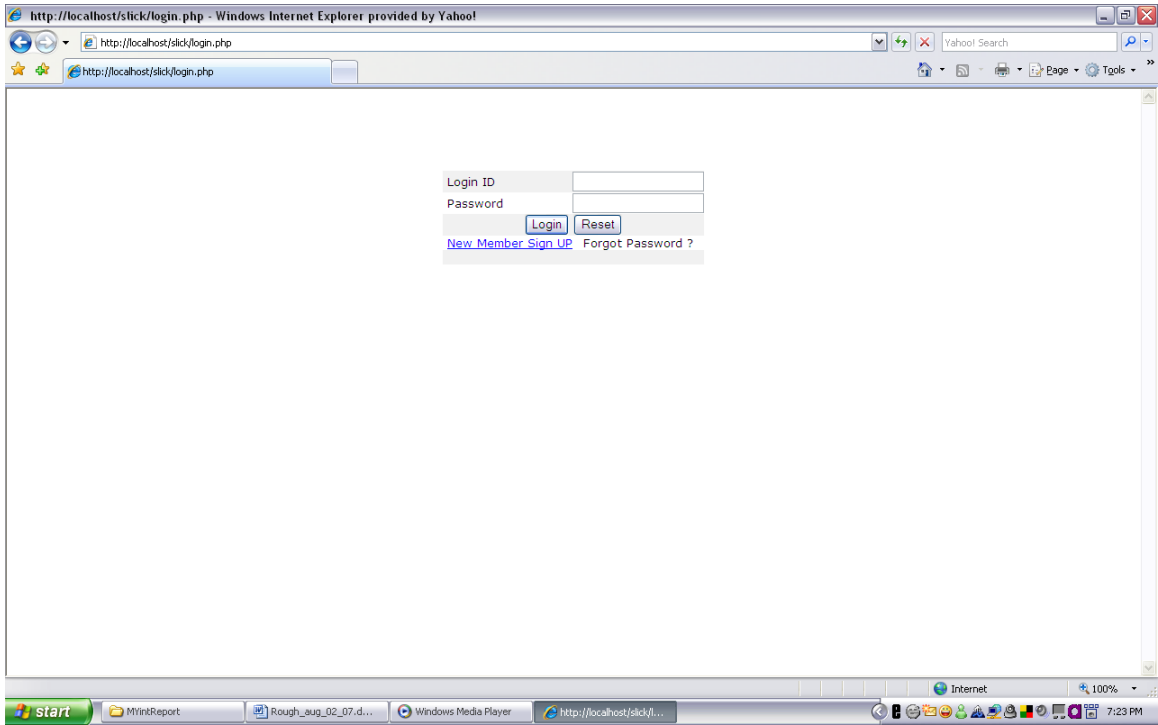
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[5] Health Informatics J. 2007 Mar; 13(1):47-56., Managing integration work in an NHS electronic patient record (EPR) project. PMID: 17296618 PubMed

[6] J Am Med Inform Assoc. 2007 Mar-Apr; 14(2):175-81. Epub 2007 Jan 9. Integrating incident reporting into an electronic patient record system. PMID: 17213499 PubMed

## 9.0 APPENDIX A: EXAMPLE OF SOME SCREEN SHOTS

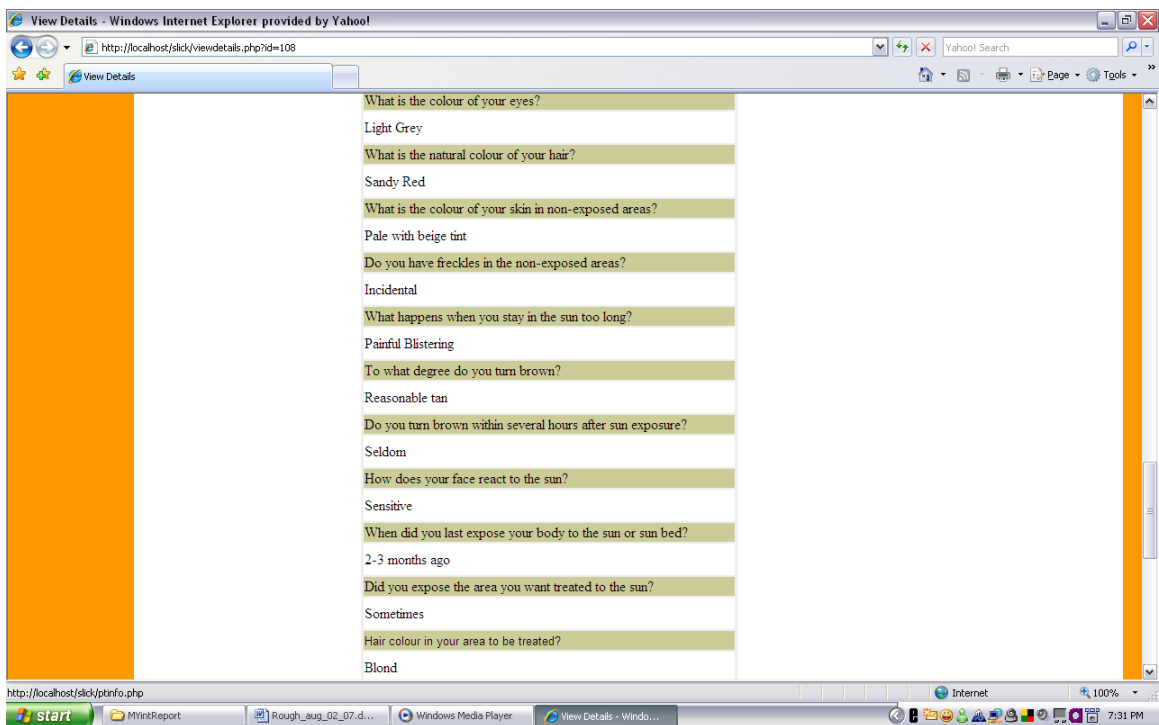


**Figure 1:** Login page of Electronic Patient Record





**Figure 2:** Records showing patient's demographic information



**Figure 3:** Records showing patient's medical history

## 10.0 APPENDIX B: EXAMPLE OF SOURCE CODE USED IN EPR

```
<?php
class navbar {
    var $numrowsperpage;
    var $file;
    var $total_records;
    var $records_number;

    function navbar(){
        $row = $_REQUEST['row'];
        $this->numrowsperpage = 10;
    }

    function execute($sql) {
        $row = $_REQUEST['row'];
        if (!isset($row)) $row = 0;
        $start = $row * $this->numrowsperpage;
        $from_start = strpos(strtolower($sql),"from");
        $result = mysql_query("select count(*) cnt " . substr($sql,$from_start));
        $obj = mysql_fetch_object($result);
        $this->total_records = $obj->cnt;
        return mysql_query("$sql limit $start, $this->numrowsperpage");
    }

    function build_geturl()
    {
        global $REQUEST_URI, $REQUEST_METHOD, $HTTP_GET_VARS,
        $HTTP_POST_VARS;
        $row = $_REQUEST['row'];
        list($fullfile, $voided) = explode("?", $REQUEST_URI);
        $this->file = $fullfile;
        while (list($key, $value) = each($HTTP_GET_VARS)) {
            if ($key != "row")
                $query_string .= "&" . $key . "=" . $value;
        }
        while (list($key, $value) = each($HTTP_POST_VARS)) {
            if ($key != "row")
                $query_string .= "&" . $key . "=" . $value;
        }
        return $query_string;
    }
}
```