CHAPTER 2:

LITERATURE REVIEW

2.0   Literature Review

2.1   Introduction

Literature review is carried out with the intent to gather background information pertaining to the research. The literature review also includes the understanding of relevant findings of others and the ability to summarize this information for the needs of the research.

The first section of this chapter is on definitions of terms that apply to the project. This is followed by description on patient history, development tools, and the concept of client/server. Finally reviews on existing systems and suggested modules are discussed.

2.2   Definition of the Dissertation Title

Patient History and Analyzing Patient History are the central issues in this dissertation. Thus, clear definitions of these two issues within the context of this study are necessary. Following are the definitions of the words related to the dissertation title:

1. The term *patient* has numerous definitions. These include:

a. On-line Medical Dictionary [1997]

    i. "A person who is receiving medical treatment, especially in a hospital."

    ii. "A person who is registered with a doctor, dentist, etc and is treated by him when necessary."

2. The term *history* carries various meanings in different contexts. In essence history means past events. In discussing history as it relates to patient and medical treatment, the following definitions can be accepted:

a. Websters Dictionary [1998]

   i. "A learning or knowing by inquiry; the knowledge of facts and events. so obtained; hence, a formal statement of such information; a narrative: a description; a written record; as, the history of a patient's case; the history of a legislative bill."

   ii. "History, Chronicle, Annals. History is a methodical record of important events, which concern a community of men, usually so, arranged as to show the connection of causes and effects, to give an analysis of motive and action etc. A chronicle is a record of such events, conforming to the order of time as its distinctive feature. Annals are a chronicle divided up into separate years.

3. In the process of understanding the term analyzing, various definitions on other terms related to analyzing is given below:

a. On-line Medical Dictionary [1997]

- *analysis*

   i. "The separation into component parts or elements, the act of determining the component parts of a substance. "

b. On-line Medical Dictionary [1998]

- *analysis of variance*

i.   "A statistical technique that isolates and assesses the contributions of categorical independent variables to variation in the mean of a continuous dependent variable."

c.   On-line Medical Dictionary [1998]

- *discriminant analysis*

i.   "A statistical analytic technique used with discrete dependent variables, concerned with separating sets of observed values and allocating new values. It is sometimes used instead of regression analysis."

d.   Websters Dictionary [1998]

- *analyze*

i.   " To subject to analysis; to resolve (anything complex) into its elements: to separate into the constituent parts, for the purpose of an examination of each separately; to examine in such a manner as to ascertain the elements or nature of the thing examined

4.   The term *system* has numerous definitions. One of the definition is given below:

a.   The Little Oxford Dictionary [1997]

i.   "A system is a collection of elements or components that are organized for a common purpose."

2.3   Review on Patient History

The patient history is the recording of the patient's health status written up by the physician and nurse. It attempts to describe the development of health symptoms that caused the patient to seek medical help. Patient history is missing in many medical information systems for two main reasons, which are strictly correlated: the methodological problem of formalizing and treating temporal information, and the practical difficulty of its routine acquisition [Bortolan et al., 1990]. Typically, the complete patient history has been the responsibility of the physician with other aspects covered by nursing and other health team members. The patient history is important as the foundation for the assessment process and for finding an accurate diagnosis.

The History of the Present Illness

The history of the present illness is the chronological description of each symptom listed in the chief compliant. The chief compliant is the patient's explanation of why they sought medical help. The chief compliant may be one or a dozen symptoms and should be recorded in the patient's own words without diagnostic interpretation. To obtain an accurate patient history, the patient is first asked to describe the progression of their symptoms.

Admission Notes

The admission sheet contains personal data about the patient. This may include the patient's name, address, date of admission, birthdate, admitting physician,

marital status, nearest relative, occupation, employer, diagnosis, religion, and record of previous admissions.

Respiratory Care Orders

The physician in the physician orders section of the medical chart will write orders for respiratory care. Orders are written chronologically with the most recent orders at the front of the section. Orders are dated along with the time the order was written. Verbal orders may be taken by the therapist and written on the physician's order sheet if need be. The therapist signs the order and an indication is noted that it was a verbal order was taken from the physician, who will cosign the order later on.

Progress Notes

The progress notes section of the medical chart contains a sequential and detailed listing of everything that was done to the patient. In many institutions, the SOAP format [Weed, 1969] is used.

S = Subjective Data

O = Objective Data

A = Assessment

P = Plan of Action

The physician, the nurse, and the respiratory therapist make progress notes. The physician's progress notes will contain a record of the progression of the patient's condition along with future plans for treatment. The progress notes will not contain the physician's orders for treatment.

There is also a progress notes section for nursing. In many institutions a respiratory section is included where respiratory progress notes can be recorded. Charting documentation should include dates, times, observations, treatments, and results of patient care. Progress notes usually take the form of narrative note taking where the patient's progress is described on a day-to-day basis.

The respiratory therapist should review the patient's progress notes before beginning a therapeutic procedure. If changes are noted in the physician's progress notes, the orders section of the chart should be examined to look for any new physician orders.

SOAP Format

The narrative note includes Subjective or symptomatic data, Objective data. Assessment, Plans.

Subjective data:	Symptoms as given by the patient.
Objective data:	Observations of the patient and specific things done for the. patient.
Assessment:	Interpretation of the facts (the S+O) expressed as an impression or as a diagnosis.
Plan:	Revision of the initial plan for more data, treatment and Education.

The flow sheet is used to show the progress of variable data that relate to one or more problems.

A discharge summary is done in the SOAP framework:

1. Record the status of the patient at discharge.

2. Inform referring physicians of the hospital findings and suggestions for continuing care.

3. Provide information to third parties paying for the hospitalization.

The content of progress notes is the documentation of the patient care process and it should reflect the quality of that care. An example would be:

Temporary problem - sore throat

S: Complaining of sore throat, especially on swallowing.

O: Mild erythema of post-pharynx, no exudate noted. Afebrile, no enlarged nodes.

A: Probable viral pharyngitis.

P: Culture the patient's throat.

Patient history for heart attack

Patient history covers aspects of the patient's condition prior to this heart attack episode that has a bearing on survivability. Patient history is not concerned with the patient's condition during the admission to the hospital or at the time of the heart attack itself. For example, under history one may indicate whether or not the patient has a history of stroke. If the patient actually had a stroke *before* the heart attack, the Stroke or TIA box should be marked. However, if the patient had a stroke *during* this hospitalization or concurrent with the heart attack, the Stroke or TIA is not marked.

Patient Information are as following:

• Patient name & ID number

• Patient demographic and contact information

• Responsible clinician(s) and professional degrees

• Dates of first contact, follow-up services, and discharge

• Information about relevant medical considerations

• Medications used by patient

2.4   Survey on Development Tools

The system to be developed involves incorporation of many features such as database management, report generation, statistical analysis, and sound effect. Therefore, study was carried out to determine the tools that perform these features. The following sections give a brief description on each of the tool.

2.4.1 Statistical Package

Table 2.1 shows the available statistical packages in market and brief description on the packages.

Table 2.1: Statistical Packages Survey

Statistical Package	*Description*
Analyse-It Software, Ltd.	Statistical software integrated into Microsoft Excel. Offers a range of statistical procedures including ANOVA and regression, plus a specialized package for clinical method evaluation.
Abacus Concepts, Inc	Makers of StatView(r), sophisticated, yet easy to use statistical data analysis software. Available for Windows 3.1, NT, '95, Macintosh, Power Macintosh.
ACL Software	Data analysis software for Windows, DOS, MVS and Macintosh.
SPSS, Inc. (3)	Statistical analysis software for Windows, DOS, MVS and Macintosh.

| Stata Corporation | Develops and distributes Stata, software for statistical analysis. Stata is available for Windows. DOS, Macintosh, and Unix computers. |
| StatSoft, Inc. | Statistics and graphics software. |

Stata

Stata is an environment for manipulating and analyzing data using statistical and graphical methods. Stata is an integrated package and not a collection of separate modules. Users can intersperse data management, statistical, and graphical commands.

Stata has two modes for use, which are the interactive and batch modes. In interactive mode, sessions are run interactively from the command line. It is useful for exploring data and relationships. In practice, the command line procedure is very fast. The analysis itself is incredibly fast as Stata keeps the data in memory [StataCorp, 1999]. In batch mode, analyses are run from scripts (.DO files). Most users run a log file from their session. The list of review commands can be saved into a .DO file for editing and subsequent use in batch processing. Therefore, Stata is fully programmable whereby users can create their own routines.

Stata was the preferred statistical package for the project as there are many advantages of Stata. The advantages are as follows:

- Provides a broad range of statistics

- Intended for researchers of all disciplines.

- Reasonably priced.

- Have complete data-management capabilities. Stata is not just a statistics package but it is a full data-management system with statistical capabilities.

- Easy to use and fast

- Available for Windows, Macintosh, and Unix (including Linux) computers. Stata datasets, programs, etc. can be shared across platforms without translation.

- Stata is so programmable that new commands can be add to it.

- Analyses can be documented and reproduced.

- Provides commands to analyze panel data (cross-sectional time-series, longitudinal, repeated-measures, and correlated data).

- Provides byte, integer, long, float, double, and string variables.

- Stata is a very powerful, very reliable, and very flexible program.

- Works on all sorts of platforms, including the big three: Unix, DOS and Windows, and Mac.

- Interfacing with printers, word processors, etc., is good.

- Provides the broadest statistical base for data analysis -- particularly with regard to the less commonly found routines, such as survival analysis (including Cox's regression), conditional logistic regression, ordered and multinomial logistic regression, Poisson regression, and negative binomial regression.

2.4.2 Microsoft Data Access Technology

In order to access, retrieve and share information efficiently throughout the Patient Information System, data access technologies have to be considered. Microsoft mostly provides complete set of Data Access Technologies. Microsoft's set of Data Access Technologies includes VB SQL, Open Database Connectivity (ODBC), Data Access Object, Remote Data Object, Active Data Objects (ADO) and OLE-DB.

1. VB SQL

Every machine using Microsoft Visual Basic has access to DB Library. This interface provides efficient point-to-point access to MS SQL Server for programmers. However, the use of this technology is declining, as less programmer-intense solutions are available.

2. Open Database Connectivity (ODBC)

ODBC is an open standard API that is fully aligned with XOPEN & ISO Standards. ODBC allows a single uniform language to access different databases, instead of using the propriety language of each database by designing a standard set of API's [Fleet, 1997]. It allows applications to access different SQL data sources at run time without recompiling the application for each target database. ODBC is based on a concept of database drivers that perform conversion between the ODBC API and the version of SQL employed by relational database. During run time, the ODBC driver will communicate with other drivers, doing so through a standard interface called the Service Provider Interface (SPI). ODBC is a network independent technology because it employs replaceable network libraries.

3. Data Access Object

The Data Access Object (DAO) concept was released in 1992 as part of Microsoft Access desktop database. It focuses on efficient management of desktop data and decision support level access to remote RDBMS data. It is based on Microsoft Jet database engine. Jet is a combination of a full function query processor data store, and functions as a local cursor engine that provides robust functionality

for use with data sources. It includes distributed database's query, update local data management and access to a variety of data including all popular Index Sequential Access Methods (ISAMs) and to all ODBC-based data. DAO's access to remote data involves the use of Jet engine's entire set of extended functionality.

4. Remote Data Object

On considerations to optimize speed and control, developers ignored JET when creating transaction centric application to a Relational Database Management System (RDBMS). Therefore, Remote Data Objects (RDO) was created to overcome this problem. It is an object interface that directly calls ODBC for optimal speed, control and ease of programming. RDO provides access to server side cursor as to minimize network traffic.

5. Active Data Objects (ADO)

ADO is a new technology for data access based on existing technologies and endowed with increased flexibility. The concept of ADO is based on the ability to be used in an environment whose base set of object interfaces is standardized and easily extensible as new application requirements. Therefore, multiple implementations of ADO are allowed; each with specific usage such as desktop, client- server, and distributed transactions. ADO is an evolution of both DAO and RDO into a single, simplified, and extensible interface that will supersede all DB-Library, DAO & RDO functionality. ADO version 1.0 focuses primarily on Internet deployment as it has the ability to maintain its current state in a connectionless environment. It includes

implementation with full data manipulation capability and a downloadable, lightweight implementation available to Internet clients at runtime.

6. *OLE-DB*

OLE-DB is building a set of common services that allow these components to collaborate intelligently. It covers the entire component spectrum, from fine-grained objects to coarse-grained existing applications. OLE-DB is a C/C++ language component architecture that was designed primarily for use by third party software developers. The purpose of the OLE SQL is to extend the reach of application capabilities beyond the limitations of ODBC. It is a COM-based API with features that provide access to both SQL and non-SQL data sources and also to provide an environment where database components can be replaceable.

2.4.3 ActiveX Controls

ActiveX controls (formerly known as custom or OLE controls) like a built-in control, is an object that an individual place on a form to enable or enhance a user's interaction with an application. ActiveX controls have events and can be incorporated into other controls. These controls have a .ocx file name extension. ActiveX provides a number of enhancements specifically designed to facilitate distribution of components over high latency networks and to provide integration of control into Web browsers. These enhancements include features such as incremental rendering and code signing, to allow users to identify the authors of controls before allowing them to execute.

2.4.4 Microsoft Visual Basic 6.0

Microsoft Visual Basic 6.0, the professional edition will be used as the main development tool for the proposed system. Microsoft Visual Basic version 6.0 has been incorporated with a number of new and enhanced features; thus this makes it more powerful and easier to use than previous versions. The features are as below:

Table 2.2: New and Enhanced Features of Visual Basic 6.0

Features	Description
Native code compiler	VB 6 has the capability to compile a program to native code, much as C++. Therefore the processing power will be faster. However, VB runtime library file is still needed to provide a fully functional program.
New database features	Visual Data Manager is the new feature in VB 6. It eases the maintenance of database structure, as well as to input and edits the actual data. Additionally, the Visual Data Manager helps to create, test and save SQL elements in a program.
Internet features	VB 6 includes ActiveX controls and Web Browser control to help Internet developers or programmers.
Others	Other features include the enhancement to Code Editor and Development Environment.

In the process of developing VB 6.0, Microsoft addressed the following data productivity objectives [Microsoft Visual Basic, 2000].

- Provide a faster and more comprehensive data access. Also to ensure that data access is fast and efficient through improved database drivers and data access components.

- Provide a comprehensive data connectivity to take advantage of existing data regardless of its form or location.

- Provide an integrated set of database design and programming tools. It means. to integrate the necessary tools for all phases of client/server programming, including database design and diagramming, query and stored procedure creation and debugging, and the creation of data-access components.

- Simplify the creation of data-centric applications for the mobile user.

- Provide the support for the latest database management technology using ActiveX Data Objects (ADO) and OLE DB. Other than that, it supports the latest relational and non-relational database technologies, including ODBC and OLE DB, with native SQL server and Oracle OLE DB support. VB Version 6.0 also introduces ADO as the powerful new standard for data access in VB, while still supporting existing DAO and RDO data access interfaces.

- Provide an easier access to more data types by the creation of reusable data sources that can be shared across projects and developers. In addition, to provide an easy access to legacy or proprietary data.

2.4.5   Seagate Crystal Reports 6.0

Database reporting can be accomplished in an easier way by using the reporting product called Crystal Reports. The Crystal Reports custom control that comes with Visual Basic allows users to access reports from within the Visual Basic program. The Crystal Reports controls provide a link between the Crystal Report engine and the reports created with the report designer [Crystal Reports, 1999].

Seagate Crystal Reports™ was chosen for the proposed system as it contains innovative features that are useful to integrate sophisticated reporting into the database applications. It has many extensive capabilities and is designed to provide the greatest possible flexibility in designing reports. There is wide variety of report types in Seagate Crystal Reports. Among the report types are form reports, summary reports, multiple detail reports, conditional reports, sub reports, cross-tabs, drill-down, Top N, mailing labels, and others. The features are as follows:

- Faster report processing

- Presentation-quality reports can be created based on the end users demand

- Report from virtually any data

- Ease of report preparation

- Integration into web applications

- Built a scalable web reporting solution

Furthermore in Seagate Crystal Reports a variety of objects can be inserted to the report. Among the objects that can be inserted are:

- Field objects

  Fields from database tables and from the result sets returned by formulas, parameter, group name, queries, and stored procedures.

- Text objects

  Characters, words, even entire documents.

- Picture objects

  Bitmaps files with the extensions- *.bmp, *.pcx, *.tif, *.tga, *jpeg.

- Graph/chart objects

  Graphs that display summarized data.

- Subreport objects

  Reports within reports, freestanding or bound to the data in the primary report.

- Cross-tab objects

  Spreadsheet-like reports that help identify trends.

- OLE objects

  Pictures, spreadsheets, text, and other objects created in OLE server applications.

2.4.6 Macromedia Flash

Flash 4.0 by Macromedia is the easiest way to create fast web multimedia [Flash, 2000]. Flash is the web standard for vector graphics, animation, and sound. It enables users to create interactive web animations, interfaces, buttons, drawings, cartoons and more. The features of Macromedia Flash 4.0 are as below:

- Includes new Flash Player JAVA Edition for output of Flash files

- *Flash 4.0* allows both professional and amateur Web designers to deliver fast interactive animations, buttons, graphic and now, sound over slower modem connections.

- The Shockwave Flash player and file format are extremely compact and make it a snap for everyone on the Web to view dazzling Web creations.

- *Flash 4.0* is the first tool for creating and animating vector-based, resolution-independent graphics without programming.

- Macromedia offers developers *Flash 4.0* to create fast and fun Web animations that can be placed throughout a Web site. and Director 6 to develop CD-quality Shockwave content, like games and simulations.

- *Flash 4.0* includes enhanced bit map editing, enabling vector and bitmap integration.

- Can import digitized photographs into Flash that can be tint, erased, brightened or use as a tiled fill.

- *Flash 4.0* also features a new capability that converts pixel-based GIFs or JPEGs into ultra-small, independent vector-based graphics, new Flash Player JAVA Edition for output of Flash files, new movie clip and button actions that require no scripting, and improved interface design and functionality.

The system requirements to install Macromedia Flash 4.0 are as following:

- Win95/98, WinNT 3.5.1, 4.0 or later

- 486 processor or faster

- 8MB Random Access Memory (16MB RAM recommended)

- CD-ROM drive

- hard disk space required.

2.4.7 Microsoft Speech API 4.0

The Direct Speech Synthesis control provides a broad level of control of text-to-speech processing. Most of the methods and properties in this control can be used with no prior initialization, as the control will self-initialize when a method or property is used. The main interface for this control is the **Speak** function. The rest of the functions and properties are optional and simply lets the user set different parameters about the voice, such as choosing which speech engine to use, as well as setting gender, pitch, and speed. This control loads the speech engine in process, so the resources used by the control are not shared with other speech applications.

2.5   Client/Server Computing

The premise of client/server computing is to distribute the execution of a task among multiple processors in a network. Each processor is dedicated to a specific, focused set of subtasks that it performs best, and the end result is increased overall efficiency and effectiveness of the system as a whole. Splitting the execution of tasks between processors is done through a protocol of service requests; one processor, the client, requests a service from another processor, the server. The most prevalent implementation of client/server processing involves separating the user interface portion of an application from the data access portion.

On the client, or front end, of the typical client/server computing is a user workstation operating with a Graphical User Interface (GUI) platform, usually Microsoft Windows, Macintosh, or Motif. At the back end of the configuration is a database server, often managed by a UNIX, Netware, Windows NT, or VMS operating system.

Advantages of Client/Server Computing

Client/Server computing model provides the means to integrate personal productivity applications for an individual user with specific business data processing needs to satisfy total information processing requirements for the entire organization. This feature has many advantages as below:

- Enhanced Data Sharing

  Data that is collected as part of the normal business process and maintained on a server is immediately available to all authorized users.

- Integrated Services

In the client/server model, all information that the client (user) is entitled to use is available at the desktop. There is no need to change into terminal mode or log into another processor to access information. All authorized information and processes are directly available from the desktop interface.

- Sharing Resources among Diverse Platforms

The client/server-computing model provides opportunities to achieve true open system computing. Applications may be created and implemented without regard to the hardware platforms or the technical characteristics of the software.

- Data Interchangeability and Interoperability

Almost all the development tools used for client/server development expect a reference to back-end database server accessed through SQL. Network services provide transparent connectivity between the client and local or remote servers.

- Centralized Management

As processing steers away from the central data centre to the remote office and plant, workstation server, and local area network (LAN), reliability can be approached by the centrally located mini and mainframe computers.

Three-Tiers Architecture

A three-tier architecture introduces a server (or an agent) between the client and the server. The agent or middle tier component is located between the client program (VB application) and the database server (Microsoft Access). The role of the agent is manifold. It can provide the following services:

- Translation services (as in adapting a legacy application on a mainframe to a client/server environment)

- Metering services (in acting as a transaction monitor to limit the number of simultaneous requests to a given server)

- Intelligent agent services (as in mapping a request to a number of different servers, collating the results, and returning a single response to the client).

2.6   Review on Medical Systems

Review was done on the following Medical Information Systems to capture the essential functions and features:

1. MEDRIS (the MEDical Record Input System)

MEDRIS was designed as a patient data input system for MEDAS. The hypermedia interface of MEDRIS was designed to help physicians to capture patient information about the history and physical examination.

2. IMR-E (Intelligent Medical Record-Entry)

IMR-E is the current development version of the input system for MEDAS. It is a knowledge-based program of medical terminology arranged into a structured format to facilitate ease of access and to expedite entry. IMR-E allows the physician to enter patient data easily and it produces standardized reports. IMR-E begins with the broad characteristics of the patient data and works down to the meticulous details of any feature in a hierarchical structure [Trace et al., 1992].

The system contains modules that collect those data terms that provide for a comprehensive textual history and physical examination document. These modules are:

- Chief complaint

- Medications/Drugs

- Past History

- Physical Examination

- Laboratory

- Special Procedures

- Radiology

- Assessment

- Plans

3. Alaris Medical Systems, Inc.

   A medical system that a design, manufactures, distributes and services intravenous infusion therapy and periodic patient monitoring instruments and related disposable and accessories. Alaris, which operates through its consolidated subsidiaries, is a leading provider of infusion systems and related technologies to the United States hospital market, with the largest installed base of pump delivery lines.

4. Weston Medical Data Systems

   Weston Medical Data Systems, Inc. has been assisting decision-makers in the health care industry in turning data into knowledge. With a current all payer database in excess of 150 million inpatient and ambulatory surgery patient records, representing more than 2600 hospitals, Weston Medical Data Systems maintains one of the leading, single-source, health care data warehouses in the world.

5.   Health Care Market Analysis System (HCMAS)

HCMAS is recognized regionally as being the most cost effective, easy to use, yet powerful, system available for extracting the wealth of critical information hidden in health care administrative data repositories. Series of reports can be generated using HCMAS.

6.   PeriData

PeriData is a program that assists ophthalmologists and medical staff with storage and analysis of visual field data. Among the functions and features of PeriData are:

- receive data from different perimeter instruments
- store the perimetry data on the PC
- integrate the data into medical record software
- display visual fields with multiple, visual graphics and analysis

2.6.1   Reviews on Necessary Modules

A study was done on important modules to be included in the proposed system. These modules include the search functions, discharge instructions, payment summary, and reporting. Examples of discharge instruction forms and search function are shown in the figures below.
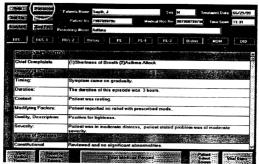
Fig. 2.1: Doctor's Choice Discharge Instructions

This user specified instruction sets might be saved for use over and over. Discharge instructions can be accessed from the edit screen or from the Main Active Patient screen.
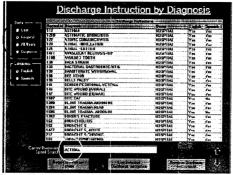
Fig.2.2: Discharge Instruction by Diagnosis

The yellow circle indicates what archive the user wants to use to select a discharge instruction from. The red circle indicates the choice of language. The blue circle indicates the active choice box.

Please choose the format of search

O **By patient history**   OBy diagnosis

Patient History Keywords:

Diagnosis Keywords:

Organ System(s):

Other Descriptive Keywords: O male   O female

Patient Gender:

Patient Age:

Case Difficulty:

Case Type:

Fig.2.3: Case Database Search

2.6.2 Reviews on Types of Analysis

Reviews were done on types of analyses performed on the medical records and the importance of these analyses to the physicians and other medical staffs. Analyses are usually performed on diseases according to age-bands and gender. Other than that, analyses are also based on the factor race, occupation and life style.

The graphs and charts, which are the outcome of the analysis, help physicians and other medical staffs in decision-making. For instance, the physicians will be aware of the medications that are suitable for the patients, type of diet and healthier lifestyle to be followed by the patients. Furthermore, the analysis also helps the medical community to prepare facilities for the patients.

2.7   Summary

This chapter mainly discusses on the development strategies. It also makes an assessment of the existing medical systems. The features of the administration and client section of the proposed system will be based on the existing system but enhanced to add necessary features and functions. Since, none of the reviewed systems incorporate statistical analysis to their medical information system, emphasis will be given on integration of the statistical package to the system. The statistical package, Stata was chosen for this purpose as it is cheaper compared to other statistical packages and performs wide variety of statistical analysis.