A Qualitative study on steps involved in Implementation of Vista Laboratory Information System in hospitals

A Dissertation Proposal for

Post Graduate Diploma in Health and Hospital Management and specialization in Healthcare Information Technology

By

Kanika Arora

PG/09/18

Under the guidance of

Mr. Akbar Basha

Designation:

Organization: DELL SERVICES

Mr. I Bhattacharya

Designation: HOD of HIT

Organization: IIHMR, New Delhi

International Institute of Health Management Research

New Delhi

Date

A QUALITATIVE STUDY ON STEPS INVOLVED IN IMPLEMENTATION OF *V*ISTA LABORATORY INFORMATION SYSTEM IN HOSPITALS

A dissertation submitted in partial fulfillment of the requirements

For the award of

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Designation:

Organization: Dell Services

International Institute of Health Management Research

New Delhi -110075

Acknowledgement

I owe my deep sense of gratitude to **Mr. Akbar Basha**, my mentor, for giving me an opportunity to learn various aspects of Healthcare Information Technology with special emphasis on LIS module of vista EHR.

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My sincere gratitude to Mrs. Maitreyi Kollegal, Director, International Institute of Health Management Research, New Delhi, who always has been a source of motivation and inspiration.

CERTIFICATE OF INTERNSHIP COMPLETION

Date:……..

TO WHOM IT MAY CONCERN

This is to certify that Ms. **Kanika Arora** has successfully completed her 3 months internship in our organization from August 9, 2010 to November 9, 2010. During this intern she has worked on……. (task performed) under the guidance of me and my team at DELL Services.

……. (Any positive/negative comment)

We wish him/her good luck for her future assignments.

(Signature)

_____ (Name)

_____Designation

CERTIFICATE OF APPROVAL

The following dissertation titled "**A Qualitative study on Steps involved in Implementation of Vista Laboratory Information System in hospitals** " is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of Post- Graduate Diploma in Health and Hospital Management for which it has been submitted. It is Understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation .

Name	Signature
_____	_____
_____	_____
_____	_____

CERTIFICATE FROM DISSERTATION ADVISORY COMMITTEE

This is to certify that Ms. Kanika Arora, a participant of the Post- Graduate Diploma in Health and Hospital Management has worked under our guidance and supervision. She is submitting this dissertation titled "**A qualitative study on steps involved in Implementation of Vista Laboratory Information System in hospitals**" in partial fulfillment of the requirements for the award of the Post- Graduate Diploma in Health and Hospital Management.

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Prof. Indrajit Bhattacharya	Mr. Akbar Basha
Assistant Professor	Implementation Specialist
IIHMR	Dell Services
New Delhi	Sec.125, Noida, UP
Date	Date

Abstract

STUDY OF THE STEPS INVOLVED IN IMPLEMENTATION OF *V*ISTA LABORATORY INFORMATION SYSTEM IN HOSPITALS

BY

KANIKA ARORA

Implementation of an application in a Hospital, is a long, time consuming, profitable but a difficult job. Apart from being a long process it is also a step wise process which requires profound and comprehensive understanding of the department as well as the application.

The application here in the client's hospital which was going to be implemented in the hospital was veterens health information system and technology architecture (Vista).

This study focuses on all the stages one has to undergo during the implementation of such an application. The main stages are:

1. Demonstration of the product
2. Requirement gathering and gap analysis
3. Designing the workflows.
4. Data collection for implementing the system.
5. Data verification
6. Configuration of the system
7. Training of the super users and end users
8. User acceptance test
9. Go-live
10. Integration with analyzers

The major findings are:

There were 124 business requirements of the client out of which, after implementation of this application 98 could be fulfilled and 26 were out of the scope of Vista. This implies that the application is able to fulfill approximately 80 percent of the client's needs.

There were a total of 684 tests and panels which were configured, out of which 634 were individual tests and 50 panels of various tests.

There were 3395 end users and 227 super users to be trained in all the 8 client's hospitals.

The methodology adopted for the project was:

Collection of the primary data

Collection of the secondary data

The primary data was collected by interviewing various implementation consultants department wise and the secondary data was collected by using the artifacts already collected by laboratory implementation specialists by site assessments and interviews with the hospital's staff.

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Acronyms / Abbreviations / Key words

ADOPTS	Access, Define, Optimize, Prepare, Transform, Sustain
CPRS	Computerized Patient Record System
EHR	Electronic Health Records
HIS	Hospital Information System
CPOE	Computerized Patient Order Entry
MAR	Medication Administration Records
BCMA	Bar Code Medication Administration
VistA	Veterans Health Information Systems And Technology Architecture
ADR	Adverse Drug Events
MH	Multi-speciality Hospital
ME	Medication Errors
DOW	Data Object Worksheet
MUMPS	Massachusetts General Hospital Utility Multi-Programming System
FSW	Future State Workshops
KT	Knowledge Transfer
HL7	Health Level 7

List Of Appendix

Part I - Internship Report

1.1 Organization Profile

1.1.1 History

Dell Services is an information technology services provider based in Plano, Texas, USA. Peter Altabef has served as president and chief executive officer since 2004. On September 21, 2009, Perot Systems agreed to be acquired by Dell for $3.9 billion. H. Ross Perot and eight associates founded Perot Systems in June 1988 after having sold electronic data system (EDS) to General Motors. Before its acquisition by Dell Inc., Perot Systems was a Fortune 1000 corporation with more than 23,000 associates and 2008 revenues of $2.8 billion. The company maintains offices in more than 25 countries around the world, including the United States, Europe, India, China and Mexico(6.1)

As a top-five finisher for the third consecutive year, Perot Systems was named to the Fortune magazine "Most Admired Companies in America" list for IT Services in 2008.

The acquisition---Dell has acquired perot systems, creating comprehensive, customer-focused IT-solutions Company. The acquisition will result in a compelling combination of two iconic information technology brands.
The expanded Dell will be even better positioned for immediate and long-term growth and efficiency driven by:--

- Providing a broader range of IT services and solutions and optimizing how they're delivered
- Extending the reach of Perot Systems' capabilities, including in the most dynamic customer segments, around the world
- Supplying leading Dell computer systems to even more Perot Systems customers.

Location Express Way, Noida

Perot Systems TSI (India) Ltd.

Corporate Office Plot No. 3 Sector 125

Noida- 201301 U.P

1.1.2 Division Of Work In Implementation

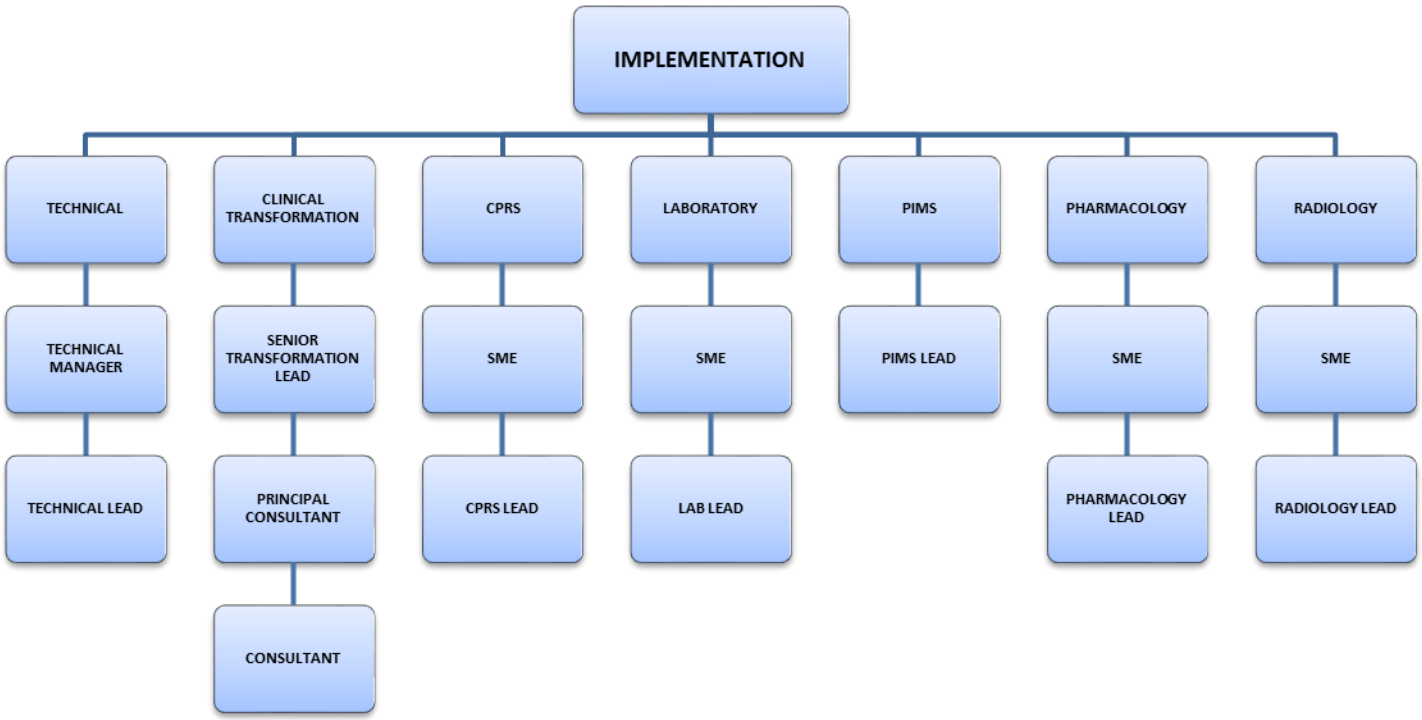

FIGURE 1: IMPLEMENTATION TEAM

1.2 Area Of Engagement

The area of engagement in the organization during the internship was the EHR Project. An Electronic Health Record is an evolving concept defined as a systematic collection of electronic health information about individual patients. It is a record in digital format that is capable of being shared across different healthcare settings by being embedded in network-connected enterprise wide information systems.

Throughout my dissertation I was mainly associated with the LIS team but for the company's requirement and my personal choice to widen my knowledge about the application, I had put my inputs in other departments like pharmacy, CPRS & in training.

The Internship involved working at both on site (Client's office) as well as off site (DELL's office).

The internship involved the visits to all the eight hospitals spread across the National Capital Region. The visits were primarily for gathering the data for the staff to be trained, and their shift timings for the training purposes. Also these sites served the purpose of interaction with the end users which has proved to be extensively useful in different stages of the project.

1.3 Implementation Tasks

Some of the tasks that were performed in the during the course of internship are stated as under

- Did Workflow Mapping of Laboratory module (Developing current and Future state Workflows)
- Did Laboratory Data Mapping (Developing Data Object Worksheets)
- Did Data Configuration for laboratory Module (Tests, Panels etc.)
- Made quick orders in CPRS module.
- Helped in preparation of Training Modules (For End user training)
- Did Data Mapping of Pharmacy Module
- Analyzed the staffing pattern and shift timings for training purposes.

1.4 Reflective Learning

During the entire process of implementation, various phases gave various types of knowledge varying from soft skills, stress handling to technical advancements and techniques development, this variation widened the horizon and gave an in depth knowledge of the application and the entire implementation process. Apart from that the experience of my mentor has been very useful for knowledge transfer.

Some of the learning during the entire internship programme is as under

- Practical issues which may hurdle the implementation process at various stages were observed
- The various perceived risks and benefits among the client's staff regarding the implementation.
- Various solutions that were being thought of and implemented so as to give the proper drive to the project, by removing the hindrances were observed
- The basic workflow followed by the client in order to carry out their processes, the most important points of the workflows as well as the limitations of the workflows which was already being used by the client.
- The Laboratory Module of the EHR which is in the process of Implementation, the various functionalities supported by it as well as the various areas in the module which require customization as per the user requirements.
- Various soft skills and analytical sessions which were being conducted so as to develop a good understanding between the company and the client about the application and the implementation process.
- The various techniques involved to ensure the end user participation throughout the implementation process so that to instill a sense of belongingness in the end user regarding the EHR to get a feeling of involvement and commitment from the users.
- Meeting with the top management and the end user together to get the governing coalitions as well as the users commitment towards the process, by taking both the views on same table.
- The different ways to gauge the level of competence of the end users in order to determine the level of training that needs to be provided to equip them of the necessary knowledge required by the end users to run the EHR efficiently. This will also help in the identification of super users or champions that could help in smooth transition to the new EHR.
- The different techniques employed by the service provider for resource planning to ensure efficient resource utilization.

Part II - Dissertation Report

Dissertation On “A Qualitative Study On Steps Involved In Implementation Of Vista Laboratory Information System In Hospitals”

Part A – Dissertation Overview

1.0 Introduction

Healthcare has traditionally seen lower levels of investments in IT than other service industries which have resulted in a number of problems for healthcare providers, with systems in desperate need of modernization to overcome the challenges that have arisen over the years.

Recent advances in IT are enabling providers to improve the quality of patient care. Today's healthcare IT is much more than traditional isolated computers and unfriendly applications. Increasingly, patient care is exploiting new tool and information that systems can provide, while maintaining a patient centric approach to their use.

Fundamental to the success of investment in modern IT, however, is ensuring a holistic approach to the technology, which means understanding the strategic goals of the organization and understanding how IT, from technological and organizational perspectives, can help to achieve them.[(6.2)]

IT Driven By Care

The driving force behind the revolution in healthcare IT is the desire for providers to offer the best possible standard of care to each patient. This has driven the emergence, and growing sophistication of the Electronic Medical Records (EMR).

In 2009 the Client hospital signed a contract with DELL Services, for the implementation of vista EHR. Presently the hospital is working on HIS (Health information system).

2.0 Vision

To make the Laboratory department fully automated and integrated with the others departments so as to make work simpler, quicker, accurate and more transparent.

3.0 Need For The Study

Laboratory being one of the most important parts of hospital & has to be fully integrated with the hospital information system, so that the oraders placed by physicians may reach the lab technician timely in a systematic manner for processing and reporting, as well as the analyzers, which are going to test the specimen and send the result to the laboratory information system and since the entire health industry is taking help of IT in order to make all their processes and workflows defined, transparent and better at services, Laboratory which has got its own set of workflows and processes was a suitable example to study the entire implementation process.

4.0 Scope Of The Study

This implementation process being an ideal comprehensive process for the chain of multi-specialty hospitals, gives an excellent example which can be used in the implementation of LIS for Laboratory of any hospital or any stand alone lab.

5.0 General Objective

To study the various steps involved in the implementation of laboratory information system in hospitals.

6.0 Specific Objectives

1. Demonstration of the product
2. Requirement gathering and gap analysis
3. Designing the workflows.
4. Data collection for implementing the system.
5. Data verification
6. Configuration of the system
7. Training of the super users and end users
8. User acceptance test
9. Go-live
10. Integration with analyzers

7.0 Assumptions

- It is assumed that at the client level the various users are adept with the functional knowledge of their respective specialties.
- The department has a well established functional workflow which is adhered properly
- The service quality at the client level is of International standards
- At the service providers level it is assumed that the service providers are well equipped with the new technology and have a relatively good experience in Implementation.

8.0 Data Sources

- VistA Laboratory Module
- Client Hospital Information System
- DELL Implementation team

9.0 Work Plan

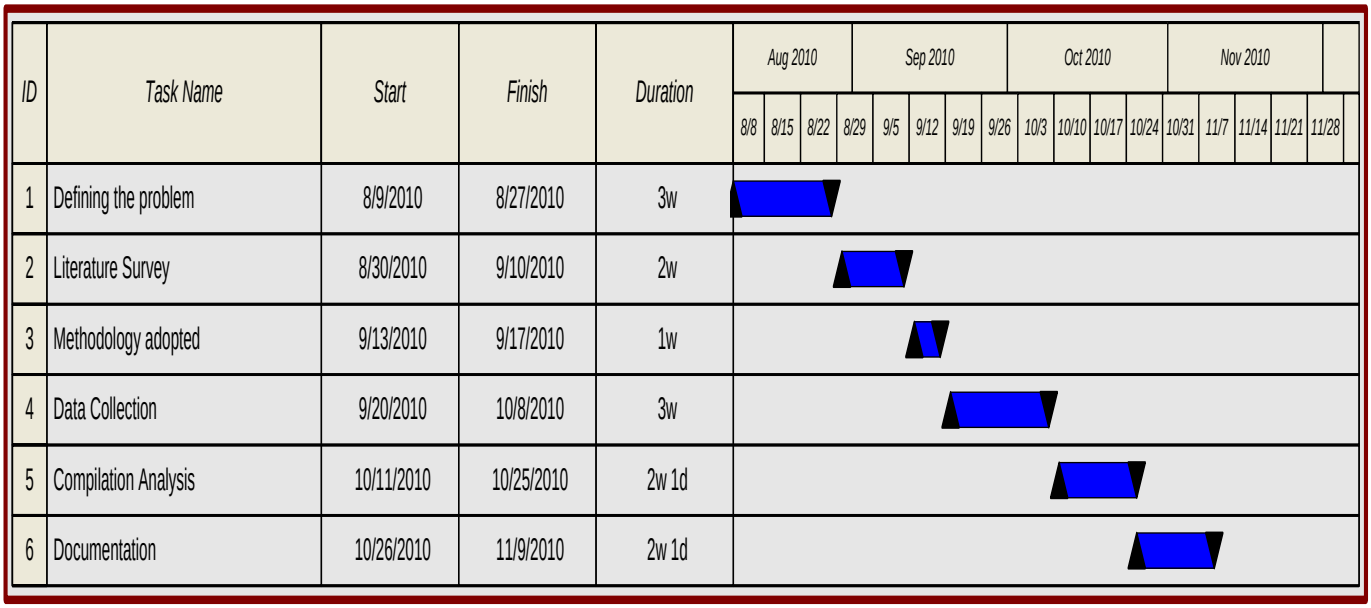

FIGURE 2 – PROJECT WORK PLAN

The study would be primarily covering the various stages of EHR Implementation being covered in Multispecialty Hospitals till date in the Data Collection and Compilation Analysis of the Work plan. The Stages include

- **Assess: -** Assessing the complete requirements of the client,
- **Design:** - Designing an existing flow and determining the gaps,
- **Optimize:** - Optimizing the workflow with realizing benefits,
- **Prepare:** - Preparing the client by imparting high level training,
- **Transform:** - Transforming the system with live implementation,
- **Sustain:** - Sustaining and providing support.

The study would involve the analysis of secondary data obtained from the artifacts present with the implementer as well as studying various other cases of implementation worldwide in order to determine the various barriers to implementation and would involve recommending various strategies that could be adopted in order to overcome the barriers.

10.0 Limitations

As during the period of study, the phases of Transform and Sustain would not be covered; therefore it would not be possible to obtain the data of the barriers faced during these phases in this project from the implementers. Therefore in such cases data could be obtained only from the past experiences of the Implementer and by analyzing the various cases of EHR implementation Worldwide.

Part B – Project Overview

1.0 Introduction

Healthcare has traditionally seen lower levels of investments in IT than other service industries which have resulted in a number of problems for healthcare providers, with systems in desperate need of modernization to overcome the challenges that have arisen over the years.

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In 2009 the Client hospital signed a contract with DELL Services, for the implementation of vista EHR. Presently the hospital is working on HIS (Health information system).

2.0 Review Of Literature

"Size up this critical medical laboratory automation component" Medical Laboratory Observer, July, 2005 by Brian Verne. Automation is a critical component in the progress and evolution of any medical laboratory. But automating a laboratory and all of its processes is not simply a matter of plugging in a few machines and watching samples line up for testing. Managers need to know what automation entails and how it fits in with their own circumstances. Because of the complexities inherent in the automation process, an explanation of those and a "how-to list" for the preparation of, transition to, and implementation of an automation line follows.

Why automate?

Most lab managers understand why automation is vital for confronting the challenges that lie ahead and recognize the importance of leveraging the opportunities it creates:

Automation can help alleviate the pending labor shortage due to fewer students. The shortage of medical technologists (MTs) is becoming more significant every year as fewer students enter the field. Annually, only 4,000 people nationwide are graduating in the field. Schools are graduating 30% fewer MT students than 10 years ago and 56% fewer MT students than 20 years ago. The shortage is so severe that it has caught the attention of the U.S. Congress: Rep. John Shimkus recently re-introduced the Medical Laboratory Personnel Shortage Act--a bill intended to encourage more students to pursue medical laboratory careers by providing financial assistance.

Automation can help alleviate the pending labor shortage due to retirement. Current professionals are reaching retirement age in disproportionate numbers. Forty percent of medical laboratory employees are between the ages of 46 and 66 according to the American Society for Clinical Pathology, and nearly half of the current workforce will be ready for retirement by 2010. The U.S. Department of Labor's Bureau of Labor Statistics estimates that 13,800 medical laboratory professionals will be needed each year through 2012 to fill vacant positions.

Automation can help respond to the increased demands that will accompany an aging population. The aging baby boomer population will soon create increased demand for medical testing. By 2040, 26% of the U.S. population will be at least 60 years old, up from 16.3% in 2000, according to the Center for Strategic and International Studies.

Automation optimizes the functioning, effectiveness, and accuracy of a laboratory. Laboratory automation allows for more testing in a shorter amount of time. It optimizes workflow processes to provide rapid, accurate, and cost-effective test results. Workstation consolidation, which reduces the amount of manual testing that is necessary, typically results from automation.

Automation can produce a more dynamic and robust laboratory. Automation typically frees up medical technologists to spend more time on the difficult cases that require careful analysis and assessment. Automation can also help a laboratory move from being viewed as an expense into being viewed as a revenue-generating resource. With an increased capacity for testing, a laboratory can expand its client base by serving outside healthcare facilities in addition to accommodating in-house needs.

Considering the possibilities

The need for automation is growing, and the benefits are compelling. Still, automating a laboratory is a significant undertaking and one that requires dedication and preparation. Labmanagers should fully understand what they need as they begin the process.

The first step is to make sure that the staff will energetically champion the effort, because the desire for automation must be strong. As with any significant change, the decision to automate may be met with reluctance and hesitation--whether from management wavering over costs or from veteran technologists wary of change.

Even the most enthusiastic advocates for automation should ensure that taking such a momentous step is justifiable. Consequently, the lab manager must assess future needs as well as current requirements. The medical laboratory should already be conducting a sufficient number of tests to justify the initial expense, although future demand may be near enough and strong enough to offset current shortfalls. Today's medical laboratory that performs 400 hematology tests a day may soon be called to perform 1,000 a day. Will the new automation system be able to handle the increased workload? Also, if a laboratory is located in a geographic area with seasonal demands, these requirements should be built into the initial assessment. For example, laboratories in Florida and Arizona experience enormous surges in capacity demands during the winter months.

The impact of transitioning

Experience has shown that the transition to automation impacts the laboratory in profound ways. Perhaps most importantly, an automated system reduces the amount of manual testing required and produces a corresponding improvement in test-result accuracy. If stringent rules and algorithms are put in place, fewer slide reviews or manual differentials may be necessary, and there will be less need for further manipulation of samples. Less sample manipulation means fewer opportunities for error.

Many laboratories use the transition to automation as an opportunity to reevaluate their own workflow rules and processes. They often review their autoverification rules or implement new tests that were previously unavailable, whether such tests offer improved precision or provide entirely new testing capabilities. Additionally, as the amount of throughput increases, more data is generated. The laboratory has to analyze more samples in less time, so decision rules, protocols, and priorities surrounding the data, as well as filtering of the data, need to be taken into consideration.

While the transition to automation causes operational and management changes in the laboratory, there are ways in which the conversion requires surprisingly little change. If the changeover is successful, laboratory customers will not see any disruption in services, since the outgoing system can typically be run in parallel with the automated system during the final transition stages. The switch to automation can be surprisingly quick, and preparation usually takes no more time than it does to bring standalone units online. Other laboratory staff members continue to perform the same functions as before--providing samples ready for testing and receiving results, although the new speed with which results are returned may be surprising.

Communication counts

A critical step during the transition to automation is to initiate an effective communication program. As the decision to automate is being made, communication with decision-makers outside the laboratory must emphasize the current and future needs of the laboratory. Executive decision-makers may be inclined to consider the merits of competing bids solely on price. While the cost factor is certainly a significant one, lab managers know that issues such as reliability, flexibility, and expandability are also important, so they must effectively communicate the relative strengths of different systems and equipment.

When the decision to automate has been made and the process is in the preparatory stages, the lab manager should communicate with other key departments in the healthcare facility. In addition to showcasing the upgrades taking place in the laboratory, the lab manager can also solicit feedback on additional, and perhaps unexpected, capabilities that other departments would like to see put into place. Similarly, the manager should also ensure that the lab staff is trained appropriately and should make other efforts to optimize the transition. It is extremely important to reassure laboratory staff that their positions are not at risk and that they will probably be moved to other areas of the lab where their high-level skills, training, and expertise will be better utilized.

Communication and cooperation with the laboratory information system team is critical. New systems must be properly integrated with existing ones, and rules and algorithms that preserve the lab's ability to properly process abnormal samples and reduce the number of unnecessary manual reviews must be written. A good vendor will provide assistance with all of these tasks.

Implementation of automation is truly an exciting process. A medical laboratory will never be the same, and a well-managed, properly automated lab will be able to meet future demands in a more effective and dynamic fashion. With the right preparation and planning, transition to automation can be conducted in a strategic manner.

Veterans Health Information Systems and Technology Architecture

(VistA)

This is open source software basically made for the service class people in US. It is an enterprise-wide information system built around an electronic health record, used throughout the United States Department of Veterans Affairs (VA) medical system, known as the Veterans Health Administration

EHR may include a whole range of data in comprehensive or summary form, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, and billing information. VistA supports both ambulatory and inpatient care(6.3)

The most significant is a graphical user interface for clinicians known as the Computerized Patient Record System (CPRS); In addition, VistA includes computerized order entry, bar code medication administration, electronic prescribing and clinical guidelines.

Laboratory Information System

A **lab information system** ("LIS") is a class of software that receives orders, and stores information generated by medical laboratory processes. These systems often must interface with instruments and other information systems such as hospital information systems (HIS). A LIS is a highly configurable application which is customized to facilitate a wide variety of laboratory workflow models. Disciplines of laboratory science supported by LIS include hematology, chemistry, immunology, blood bank (Donor and Transfusion Management), surgical pathology, anatomical pathology, flow cytometry and microbiology. Use of an LIS is a critical piece of the clinical IT spectrum of systems and contributes significantly to the overall care given to patients. The LIS is used in inpatient and outpatient settings and in many cases is designed to support both.(6.6)

Laboratory Information Systems commonly support the following features:

- Patient Registration (referral)
- Order Entry
- Sample collection
- Specimen accessioning
- Specimen Processing
- Result(s) Entry
- Reporting

Modules *V*istA offers

1) Clinical
2) Infrastructure
3) Financial-administrative
4) Healthevet

CLINICAL – CPRS

DENTISTRY

LABORATORY

RADIOLOGY

PHARMACOLOGY

SURGERY

PIMS etc

INFRASTRUCTURE – CAPACITY MANAGEMENT TOOLS

FILEMAN

HL7 (VISTA MESSAGING)

MAILMAN

NATIONAL PATCH MODULE

SURVEY GENERATOR etc

FINANCIAL-ADMINISTRATIVE SECTION – ACCOUNTS RECEIVABLE

CLINICAL MONITORING SYSTEM

FEE BASIS

INTEGRATED BILLING

RECORD TRACKING etc

HEALTHEVET – CLINICAL INFORMATION SUPPORT SYSTEM

ELECTRONIC SIGNATURE

PERSON SERVICES

REGISTRIES etc

Modules of Vista Which Are Going To Be Implemented In Client Chain of Hospitals

1) CPRS (Computerized Patient Record System)
2) LIS (Laboratory Information System)
3) RIS (Radiology Information System)
4) PIS (Pharmacology Information System)
5) PIMS (Patient Information Management System)

CPRS (computerized patient record system) – It is a comprehensive vista program, which allows clinicians and others to enter and view orders, progress notes and discharge summaries, problem list, view results, reports, etc.

CPRS organizes and preset all relevant data on a patient in a way that directly supports clinical decision making. The comprehensive cover sheet displays timely, patient centric information, including active problem, allergies, current medications, recent laboratory results, vital signs, hospitalizations and outpatient clinical history. CPRS capabilities include:

a) Real – Time Order Checking System
b) Notification System
c) Patient Posting System
d) Clinical Reminder System
e) Remote Data View

laboratory - Laboratory module enables the user with Ordering of tests and procedures on both patient and non-patient specimens, Collection and Accessioning of specimens into the Laboratory database, Processing and analysis in appropriate department or work areas, review and verification of results, Reporting of results and/or diagnoses for clinical health care treatment, Analysis and reporting of quality control data used in generating results and Providing management statistical data as well as requirements for accreditation by regulating bodies and agencies

Radiology Module - Radiology / Nuclear Medicine package is a comprehensive software package, designed to assist with the functions related to processing patients for imaging examinations. The Radiology / Nuclear Medicine package automates the entire range of diagnostic functions performed in imaging departments, including request entries by clinical staff, registration of patients for exams, processing of exams, recording of reports/results, verification of reports on-line, displaying/printing results for clinical staff, automatic tracking of requests/exams/reports, and generation of management statistics/reports, both recurring and ad hoc. The Radiology / Nuclear Medicine package automates many tedious tasks previously performed manually, providing faster, more efficient and accurate data entry and more timely results reporting. One of the important features provided by VistA is

VistA Imaging

The Veterans Administration has also developed VistA Imaging, a coordinated system for communicating with PACS (radiology imaging) systems and for integrating others types of image-based information, such as, pathology slides, and scanned documents, into the VistA electronic medical records system. This type of integration of information into a medical record is critical to efficient utilization.

Surgery Module

The Surgery package is designed to be used by Surgeons, Surgical Residents, Anesthetists, Operating Room Nurses and other surgical staff. The Surgery package is part of the patient information system that stores data on the Department of Veterans Affairs (VA) patients who have, or are about to undergo, surgical procedures. This package integrates booking, clinical, and patient data to provide a variety of administrative and clinical reports.

Pharmacy Module

The Pharmacy package provides a method of management, dispensing, and administration of inpatient drugs within the hospital. Hospital Medications combines clinical and patient information that allows each medical center to enter orders for patients, dispense medications by means of Pick Lists, print labels, create Medication Administration Records (MARs), and create Management Reports. Hospital Medications also interacts with the Computerized Patient Record System (CPRS) and the Bar Code Medication Administration (BCMA) packages to provide more comprehensive patient care.

VistA was developed using the M or MUMPS language/database. The VA currently runs a majority of VistA systems on the proprietary Intersystems Cache version of MUMPS, but an open source MUMPS (Massachusetts General Hospital Utility Multi-Programming System) database engine, called GT.M for Linux and Unix computers has also been developed. GT.M is an implementation of the Standard M programming system (M = MUMPS = Massachusetts General Hospital Utility Multi-Programming System). VistA is written in Standard M. GT.M is an implementation of M from Fidelity Information Services. In addition, the free and open source nature of GT.M allows redundant and cost-effective failsafe database implementations, increasing reliability for complex installations of VistA.

3.0 Methodology

3.1 Assumptions

- It is assumed that at the client level the various users are adept with the functional knowledge of their respective specialties.
- The department has a well established functional workflow which is adhered properly
- The service quality at the client level is of International standards
- At the service providers level it is assumed that the service providers are well equipped with the new technology and have a relatively good experience in Implementation.

3.2 Illustration

ID	Task Name	Start	Finish	Duration
1	**Defining the Problem**	**8/9/2010**	**8/27/2010**	**3w**
2	Study Implementation Project Details	8/9/2010	8/12/2010	.8w
3	Studied Worldwide Implementation aticles	8/13/2010	8/18/2010	.8w
4	Discussion with mentor	8/19/2010	8/20/2010	.4w
5	Finalizing the Dissertation Topic	8/23/2010	8/27/2010	1w
6	**Literature Survey**	**8/30/2010**	**9/10/2010**	**2w**
7	Finding Articles/ Manuals	8/30/2010	9/1/2010	.6w
8	Sorting Articles/ Manuals	9/2/2010	9/3/2010	.4w
9	Reading Articles/ Manuals	9/6/2010	9/10/2010	1w
10	**Methodology Adopted**	**9/13/2010**	**9/17/2010**	**1w**
11	Studying Various Project Methodologies	9/13/2010	9/14/2010	.4w
12	Discussion with Mentors About Methodology	9/15/2010	9/16/2010	.4w
13	Finalizing Methodology	9/17/2010	9/17/2010	.2w
14	**Data Collection**	**9/20/2010**	**10/8/2010**	**3w**
15	Client site visit	9/20/2010	10/1/2010	2w
16	Client Staff Interview	9/21/2010	10/1/2010	1.8w
17	Implementers Interview	10/4/2010	10/8/2010	1w
18	**Compilation Analysis**	**10/11/2010**	**10/25/2010**	**2.2w**
19	Data Compilation	10/11/2010	10/13/2010	.6w
20	Data Analysis	10/14/2010	10/22/2010	1.4w
21	Reviewing Analysis to Mentor	10/25/2010	10/25/2010	.2w
22	**Documentation**	**10/26/2010**	**11/9/2010**	**2.2w**
23	First Draft Preparation	10/26/2010	11/3/2010	1.4w
24	First Draft Review	11/4/2010	11/5/2010	.4w
25	Final Draft Preparation	11/8/2010	11/8/2010	.2w
26	Report Finalized	11/9/2010	11/9/2010	.2w

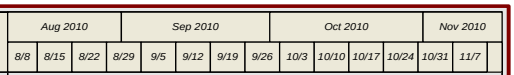


FIGURE 3 - WORK BREAK DOWN STRUCTURE

The study would be primarily covering the various stages of EHR Implementation being covered in Multispecialty Hospitals till date, in the Data Collection and Compilation Analysis of the Work plan.

3.3 Out Of Scope

1) The gaps in the requirements requested by the client, which cannot be provided by Vista will be out of scope for our implementation process.

2) Since the dissertation period will be over by the time of go –live phase, this project will not be able to cover the real challenges that the product might phase at that time.

3.4 Implementation Objectives

The main objective of this implementation is to make the entire process and all workflows of laboratory automated, systematic and easily accessible by all the staff, which interacts with it.

3.5 Implementation Assumptions

The assumptions for this implementation are:

1) The systems and the application will be available as required for the implementation
2) The data that is required to be provided by the client side will be readily available in a comprehensible form
3) The software and the server will be in place before starting off with the actual implementation process.

3.6 Art Of Implementation[6.4]

The healthcare industry is in the midst of an exciting technology transformation. With governmental bodies and trade associations calling out for widespread IT adoption, medical professionals are starting to heed these calls. Physicians of all strides are beginning to trade in their paper charts for software applications that help improve patient care, yield greater efficiency and productivity, and boost revenue. It is also said that

“Learning how to use an EHR is a lot like learning a musical instrument. The hospital don’t just pick it up the first day and expect to be a virtuoso.”

The three T’s

Team, Tactics,Technology. *Team* refers to people and organizational issues, *tactics* to specific techniques and choices made in design and setup, and *technology* to the software, hardware and network choices the company will make. Many implementation issues are common to large and small practices alike. Yet large practices, perhaps due to their complexity, tend to suffer more from team issues, and small practices, perhaps due to their more limited resources and experience, tend to falter when it comes to technology issues. Any size practice can crash and burn when it comes to tactics.

Team

Everyone in the hospital practice will play some role in the success or failure of the hospital EHR implementation. Some roles will be bigger than others, but they all need to be acknowledged and understood from the start.

Three types of leaders[6.5]

Study after study on EHR implementations reports the same thing: People are the key, and leadership is one of the biggest issues. An EHR project needs three kinds of leaders: a physician champion (or two or three), a CEO and a skilled project manager. In a small practice, the physician champion and CEO may be the same person. That should help the implementation's chance for success.
The physician champion should be a respected clinician who is a good communicator and a tireless supporter of the project. He or she should be the engine that motivates others. Physician champions are so important that one report stated, "Identify an EMR champion – or don't implement."

The CEO and the rest of the hospital practice's senior management team should fully back the project through thick and thin and help provide the needed resources. They should help clear the track of obstacles. □

The project manager should not be just any available manager. Rather, he or she should be someone who is trained, skilled and experienced in managing complex information technology (IT) projects with overlapping timelines and multiple stakeholders. Ideally, the project manager will have managed an EHR implementation before. He or she will be the engineer that keeps the train on track and anticipates the stops ahead. Large practices will need to hire a full-time manager, while small practices will likely partner their office manager with an implementation manager assigned by the EHR vendor.

Change management. Not only does an EHR project need good management, but it also needs broad stakeholder involvement, a motivated implementation team and an excellent communication plan.

The hospital will need to understand the EHR's capabilities and determine how it can be used to streamline and improve current paper-based office processes. Using an EHR will require the hospital to change the way the hospital do many things and who does what. EHRs offer an opportunity for the

hospital to improve the hospital's office efficiency and service level, but that isn't automatic. This means change, and change is a troublesome word to many people. It inspires fear, resistance and sabotage. Understanding and utilizing a good change management process will.

Expectations and goals. If the hospital buy an EHR expecting it to make the hospital loads of money without any extra work, then the hospital is on the way toward what the is perceived as a failed implementation. The hospital need to start out with realistic expectations. EHRs *do* require extra work for most users during the first year, and
financial break-evens typically don't occur until two to three years from the hospital's go-live date. Setting specific, measurable goals for what the hospital want to accomplish with the EHR will also help the hospital define what constitutes success or failure. For example, the hospital might decide that all six of the hospital's practice's physicians need to be fully utilizing all seven modules of the hospital's EHR by a target date. Or the hospital might decide to shoot for a 70-percent reduction in transcription usage practice-wide by a certain date. Goals like these should be determined early in the planning, if not before purchasing the hospital's EHR, then certainly before implementing it. Again, be realistic. This is a long-term project. That isn't to say the hospital shouldn't set high expectations.

Establishing goals that are ambitious, but achievable, can be motivating. Yet it's important to understand the hospital's users' needs, and to make sure they understand and share the stated goals. Otherwise, they might not play along, destroying the hospital's implementation plans. Finally, it's wise to monitor and communicate the hospital's progress in terms of achieving the hospital's goals. There are many ways to do this, but one easy tactic would be to display an implementation timeline poster in a break room where all staff can see it. This poster should show past and future key implementation dates and accomplishments. This will help keep things on course.

Functional organizations. If the hospital's practice is broken, the hospital needs to fix it before the hospital try to bring an EHR on board. Dysfunctional organizations are likely to have dysfunctional implementations. Excellent communication, clear lines of authority and an explicit decision-making process promote success. An implementation team composed of key stakeholders should design and monitor the implementation process, but one individual alone, the project manager, should direct the actual implementation. Of course, the project manager should do so in a collaborative, rather than a dictatorial, fashion.

Tactics

New questions will pop up almost every day while the hospital is doing an EHR implementation. With the right tactics in place from the beginning, the hospital will have answers ready – for most of them.

Plan, plan, plan. It can't be said enough. Much of an EHR implementation's eventual outcome depends on the planning the hospital do long before the hospital go live. Write the plan down. Use project management software. Talk to experts and other users.

AVOID----------→

Workflow redesign. A key piece of planning frequently mentioned by EHR implementation experts is "workflow redesign." As mentioned above, an EHR implementation offers the hospital an opportunity to improve some of the hospital's less efficient processes through automation and fewer steps. Ideally, for each major office process, the hospital should review the current paper process, analyze its steps and record them on a flow diagram.

The hospital can then determine if the process can be improved by comparing it to a flow diagram the hospital create of an EHR process that accomplishes the same thing. Office processes that the hospital should examine include medication refilling, telephone messaging, appointment requesting, lab reviewing, other test reviewing, prescription writing, patient check-in, health maintenance tracking, referral making, lab and test ordering, communicating test results to patients, interoffice messaging and note charting. Not all EHR processes will be quicker and more efficient. The hospital shouldn't insist that people switch from an efficient paper process to a less efficient EHR process just for the sake of automation. Sometimes, though, a slower EHR process can pay off in other ways, making it worthwhile.

For example, progress note documentation with an EHR is typically slower than using dictation or even a paper check-box form. However, by documenting directly in an EHR the hospital immediately gain easily readable notes at the end of the visit. Notes can then be shared with patients or consultants, or the notes can be used for immediate review of those patient-care questions that arise before a dictation would normally return.

Direct EHR note entry also commonly allows the hospital to record diagnoses and populates problem lists simultaneously. These computerized problem lists facilitate a wealth of disease management and quality improvement efforts that can only be dreamed of in the paper world.

Big bang vs. phased implementation.

Should all physicians go on the system at once? Should the hospital start all functions at once? Ideally, all physicians in one office should go on the EHR together. Otherwise, the office staff will need to run at least two different sets of processes for paper-based physicians vs. EHR physicians. Not only is that confusing, but it also is inefficient. However, if the hospital's practice has more than one office, there is no overriding reason that all practices have to go on the EHR at one time. In fact, depending on the hospital's practice's resources, the hospital might be wiser to roll out one office at a time.

A few practices have successfully implemented all functions of an EHR at once. This can be called "big bang." The consensus, however, is that success is more likely if the hospital implement functions sequentially in what is known as "phased implementation." Typically the hospital start by introducing less interactive functions first, like scanning and result reviewing, and then move on to more interactive functions, like interoffice messaging, prescription writing and note documentation. A lot of variability exists in this area, partly perhaps due to variation in EHR software. With regard to specific phased implementation strategies, the hospital should pay close attention to the hospital's EHR vendor's recommendations.

Training.

Many implementations use a train-the-trainer approach, in which a core group of people are trained directly by the vendor. This group in turn trains the rest of the users at their site(s).
Training for end users is best done within two weeks of going live so that new skills aren't quickly forgotten. One initial training session may not be enough. Teaching complex skills, like efficient note

documentation for physicians, can be started with the initial training and then advanced with briefer updates.

While some EHR skills apply to all users, distinct user groups, such as receptionists, records personnel, medical assistants/nurses and physicians, will benefit from customized training relevant to them. Training can be done classroom style, via the Web or one-on-one, depending on the hospital's resources and inclinations. Initial training time will vary depending on the hospital's software and implementation plan.

Note design.

Vendors will often supply some standard note templates for the hospital's use that their other customers have used. Given the variation in how physicians practice medicine, the hospital will most likely decide to customize these templates to suit the hospital's practice style. Some practices develop dozens, even hundreds, of templates for use in a wide variety of clinical situations. The hospital will need to consider how much leeway each physician should have on customized templates. For example, should the hospital's practice design one common template for the medical group on diabetes? Or would it work better if the hospital allowed each physician or practice site to create a customized variation? If the hospital is using a template for the purpose of disease management, then it makes sense to standardize. Otherwise, allowing individual variations will likely promote higher EHR utilization and efficiency among the hospital's physicians.

After the hospital has decided on a template policy, it still needs to offer the hospital's physicians other ways to document their patient encounters. I've found that if the hospital tries to force everyone to use the same method of note documentation, then the hospital won't be able to get everyone to use the system. Choosing an EHR product that allows a variety of ways to document notes will lead to fuller EHR utilization. In addition to templates, other documentation options include free text typing, voice recognition, partial- or full-note dictation using voice files, macro use and handwriting recognition. In some cases, a combination of these can be used to create a note most efficiently.

Going live.

If the hospital has prepared well, turning the hospital's system on, or "going live," should be uneventful. Given that Mondays are the hospital's busiest days, they are a bad choice for a "go live" day. Pick any other day. Make sure the hospital's physicians have lighter-than-normal schedules – ideally about a 50-percent workload. This will vary depending on the hospital's implementation's design. Ask the hospital's vendor what has worked best for other customers.

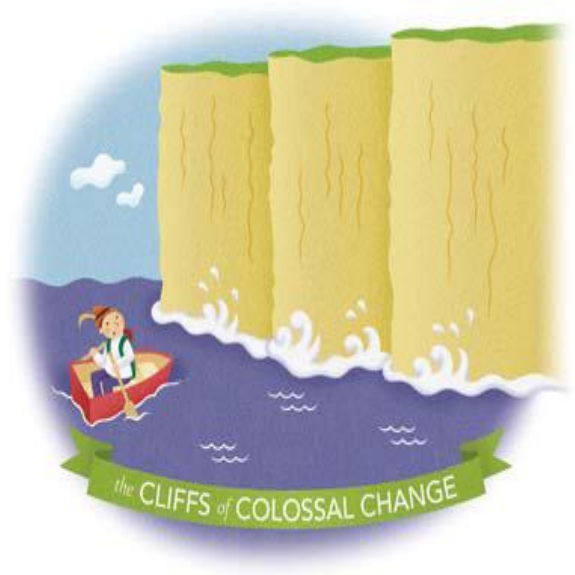
It's common to underestimate how long it will take staff and physicians to get up to speed on the EHR. Remember, learning how to use an EHR is a lot like learning a musical instrument.

The hospital doesn't just pick it up the first day and expect to be a virtuoso. Depending on the complexity of the product, basic competency can easily take six months. That's why phased implementations are typically recommended.

Support.

Adequate vendor support is essential for success. If the hospital's vendor fails to respond to the hospital's calls for help or responds too slowly, the hospital's implementation can be sabotaged. This speaks to the importance of thoroughly investigating the hospital's vendor and the product before the hospital sign the contract. A common tip for success is to create one or more "power users" at each clinical site.

These will be employees to whom the rest of the hospital's staff can turn first for immediate advice on many issues. If the issue is beyond a power user's knowledge, then it is passed up to the hospital's internal IT staff or the hospital's EHR vendor.



Technology

Many EHR experts say that people problems, or what I call “team” issues, rather than technology problems, lead to nearly all EHR failures or partial implementations. Their favorite examples always involve one practice that succeeded and one practice that failed, even though they bought the same EHR system and used the same hardware. But the experiences and conversations with other users have led experts to the perspective that technology matters too.

Need for speed and high network availability.

Poorly written software that requires numerous clicks to accomplish a process, compared to an alternate product that does the same thing with one click, makes it harder for EHR users to succeed. Inadequate server memory or processing power or poor network design can slow down common EHR tasks to the point of crippling them. Small practices should be sure to have excellent IT support or consider an application service provider (ASP) model. With an ASP, an outside entity maintains the servers and backs up the hospital’s data. The hospital just provides desktops and a broadband Internet connection.

Testing.

If the hospital is running hospital’s own servers, the hospital should have a “test” environment to mirror the hospital’s “live environment. All new software products, upgrades and patches should be thoroughly tested before unleashing them in the live environment. Otherwise, something as simple as installing a new patch could cause the hospital’s EHR to malfunction during the middle of a busy workday. After that happens a few times, the hospital’s users will be eager to go back to paper. Be aware that the hospital’s

IT personnel should perform different types of testing with names like “smoke testing,” “end-to-end testing” and “volume testing” before a new implementation. Although a detailed description of testing techniques is beyond this article’s scope, the hospital should get a list of all the recommended types of testing from the hospital’s EHR vendor and then ensure that this is done by whoever will be responsible for it in the hospital’s implementation.

IT support and maintenance.

The more complex the hospital’s server and network environment, the more support and maintenance the hospital will need. Get expert help here or suffer the consequences. Server and network hardware can be expensive. Because EHR software is also expensive and EHR vendors want to promote sales, they have a stake in quoting the hospital the minimal hardware configurations that will work with their product. Consider getting independent verification on their specifications if possible. Ask for a list of the hardware choices some of their other clients made. Also, don’t go with the minimums.

Performance will be enhanced if the hospital will have a buffer. Remember, from the end-user’s point of view, speed is everything. Having to wait for the screens to change while the hospital is in the middle of a busy day practicing medicine is not acceptable.

Disaster recovery.

The hospital will invest heavily in hardware, software and training. The hospital will reap many rewards for the hospital’s efforts. Yet there is one more investment the hospital must make that will have no obvious return. The hospital need to back up the hospital’s data daily and have a working disaster recovery plan. Think of this as an insurance policy. The hospital should test the back-ups and make sure they work. The hospital also should build redundancy into the hospital’s system to maintain high availability of the EHR. Get some expert IT advice here.

POINTS TO KEEP IN MIND BEFORTE STARTING OFF WITH THE EHR IMPLEMENTATION

- The hospital's EHR implementation has a better chance for success if the hospital organizes it into three categories: team, tactics and technology.

- Studies have found that a practice's employees are the key to an EHR implementation's outcome, with project managers playing a critical role.

- Everyone involved with the new EHR will need to be open-minded about changing the way the practice operates.

- If the hospital's EHR implementation team is given unrealistic goals, the project is likely to end as a perceived failure.

- When it comes to the hospital's implementation tactics, spend as much time as possible planning, which should cut down on surprises as the project proceeds.

- It's critical that the hospital maintain a consistent policy on who will handle data entry and which data they will enter.

- It's critical that the hospital maintain a consistent policy on who will handle data entry and which data they will enter.

- When the hospital is ready to "go live" with the EHR, try to avoid starting on a Monday, which is already the hospital's busiest day.

- Many practices designate in-house EHR "power users" to whom other employees can turn first for advice and support.

- Technological problems, such as poorly written software or inadequate server memory, can cripple an EHR implementation.

- Line up expert IT support and maintenance.
- The hospital's data should be backed up daily.
- With careful planning and good advice, the hospital's EHR project will succeed

3.7 Implementation Process Used By Dell For Laboratory Module Implementation

Implementation is a long step wise process which requires careful, detailed understanding of each step involved in it. The various steps of implementation are:

1) Demonstration of the product
2) Requirement analysis
3) Designing the workflows
4) Data Collection
5) Data Verification
6) Configuration
7) Training of the users and super users
8) User acceptance test
9) Go-Live
10) Integration with the analyzers

3.7.1 Demonstration Of The Product

The process of the implementation starts form the very first demonstration of the product once the vendor is called after submitting his quotation against the request for proposal. In this phase, a high level presentation of the product is given by the marketing team of the company where in
All the features of the product are shown to the client and the capabilities and salient features are highlighted

3.7.2 Requirement Analysis

Once the handshake between the client and the vendor is complete, after weighing all the pros and cons, a thorough analysis of the expectations and the requirements put forth by the client via group discussions, site assessments and personal interviews are analyzed, the requirements are also collected by various other means for e.g. site assessment and interviews, a comprehensive assessment of what the product can provide and what the client is expecting is done and the gaps are figured out. In case of our product, Vista Laboratory was going to be implemented and was to replace the HIS which was already working in the hospital, hence a requirement analysis was done based on the provisions of HIS and the provisions of VISTA, and it was also noted that what can be provided by Vista Lab after the customizations and what cannot be provided. The requirements are classified by color codes and are documented as:

	Available in VistA
	Not Available in VistA
	HIS Functionality
	Will be available, subject to CCN get signed.
	Will not be available in VistA, subject to CCN get signed.

CCN: Change Control Number

Req. ID	LAB-ORD-01	LAB-ORD-01
Ordering	Placing of Lab Orders of Biochemistry, Haematology , clinical pathology, microbiology, immunology is available from CPRS for OP/IP/Referral	Placing of Lab Orders of Anatomic Pathology (including bone marrow/cytology/long text results) is Unavailable from CPRS for OP/IP/Referral

Req. ID	LAB-BILL-01	LAB-BILL-02
Lab Billing	Billing for extra reports for PHC and Duplicate Reports.	IPD Lab test billing Event (Ordering, Sample Collection, Received in Lab).

Req. ID	LAB-SC-01	LAB-SC-02
Sample collection	Display Sample collection worklist in all Nursing Locations and OPD Sample collection area.	Specific to Histopathology/cytology Sample Collection

FIGURE 4 - SCREEN SHOT OF REQUIREMENTS

Req. ID	LAB-MIS-01	LAB-MIS-01
MIS	User should able to generate, maintain and print Disease specific test wise report.	User should able to generate, maintain and print Identified organism wise report

Req. ID	LAB-INC-001	LAB-INC-002
Infection Control	Provision to send the request for Infection control samples.	Dispatch list for infection control samples. Dependant on LAB-INC-001

Req. ID	LAB-GEN-03	LAB-GEN-04
General	Lab Setup & Admin configuration.	Scheduling of resources.

FIGURE 5 - SCREEN SHOT OF THE REQUIREMENTS

Module	Total Requirements	Available in VistA/HIS	Not available in VistA
Laboratory	115	92	23
Additional Requirement	6	4	2
Requirements from CRG Sign-off Meeting	3	2	1
Total	124	98	26

FIGURE 6 -SCREEN SHOT OF REQUIREMENT ANALYSIS

As shown above a complete analysis of the requirements is done and is discussed between the vendor and the client and possible solutions are presented by both the sides and the final plan is then chalked out.

3.7.3 Designing The Workflows

After the negotiations about the requirements and the offerings are closed, vendors do site assessments and interviews at various levels to check the existing workflow and see if that matches with the workflow the product is offering, there again discussions are held so as to make the product and hospital workflow compatible with each other for smooth functioning and smooth transformation of the hospital from manual work to computerized work. In this step a priority and comfort based study is done which has to be economically efficient at the same time for the hospital and it is noted that what all customizations are required and at what level i.e. either at the hospital level or at the product level. For this particular case e.g.

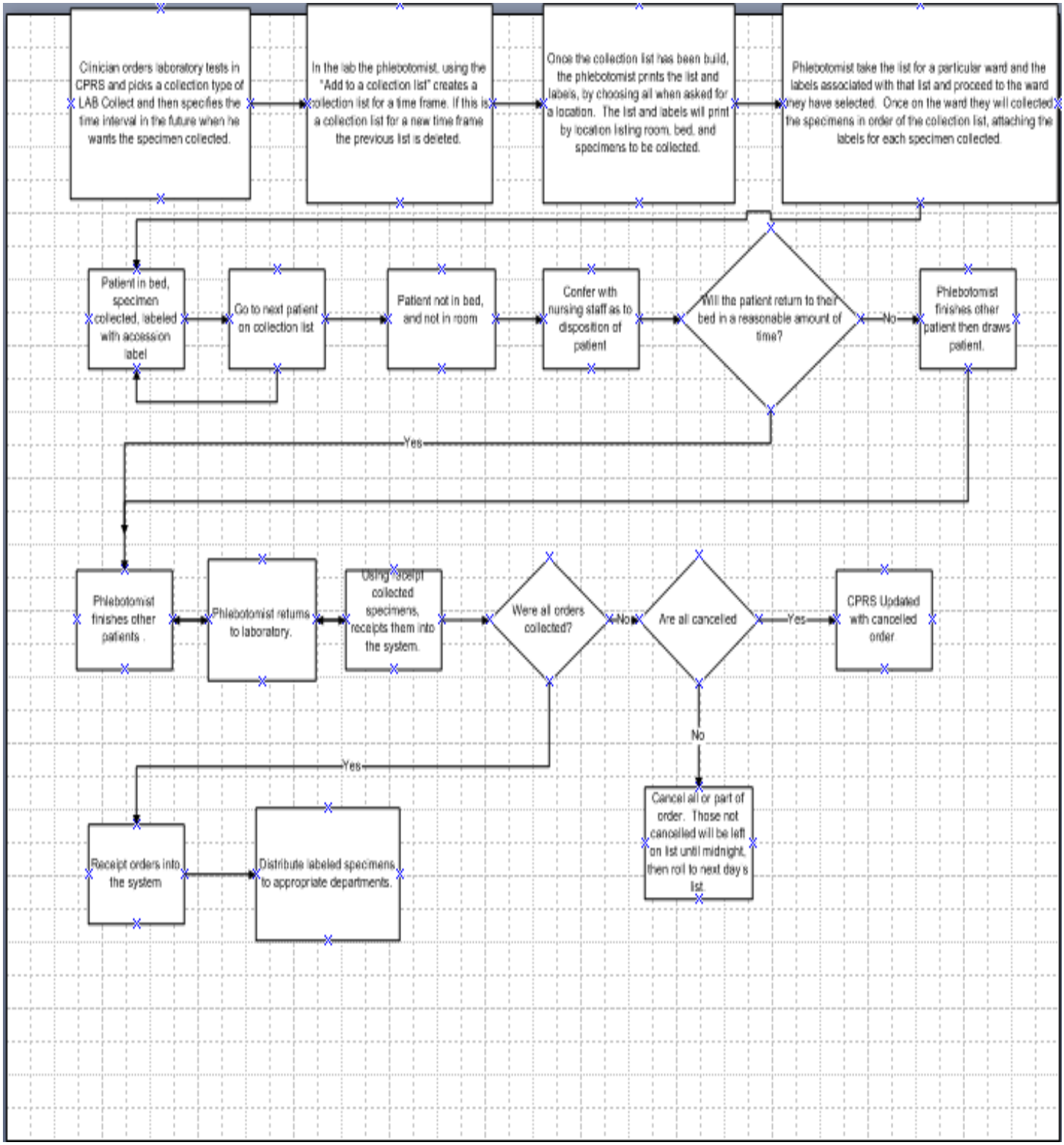


FIGURE 7 - SCREEN SHOT FOR I.P.D LABORATORY WORKFLOW

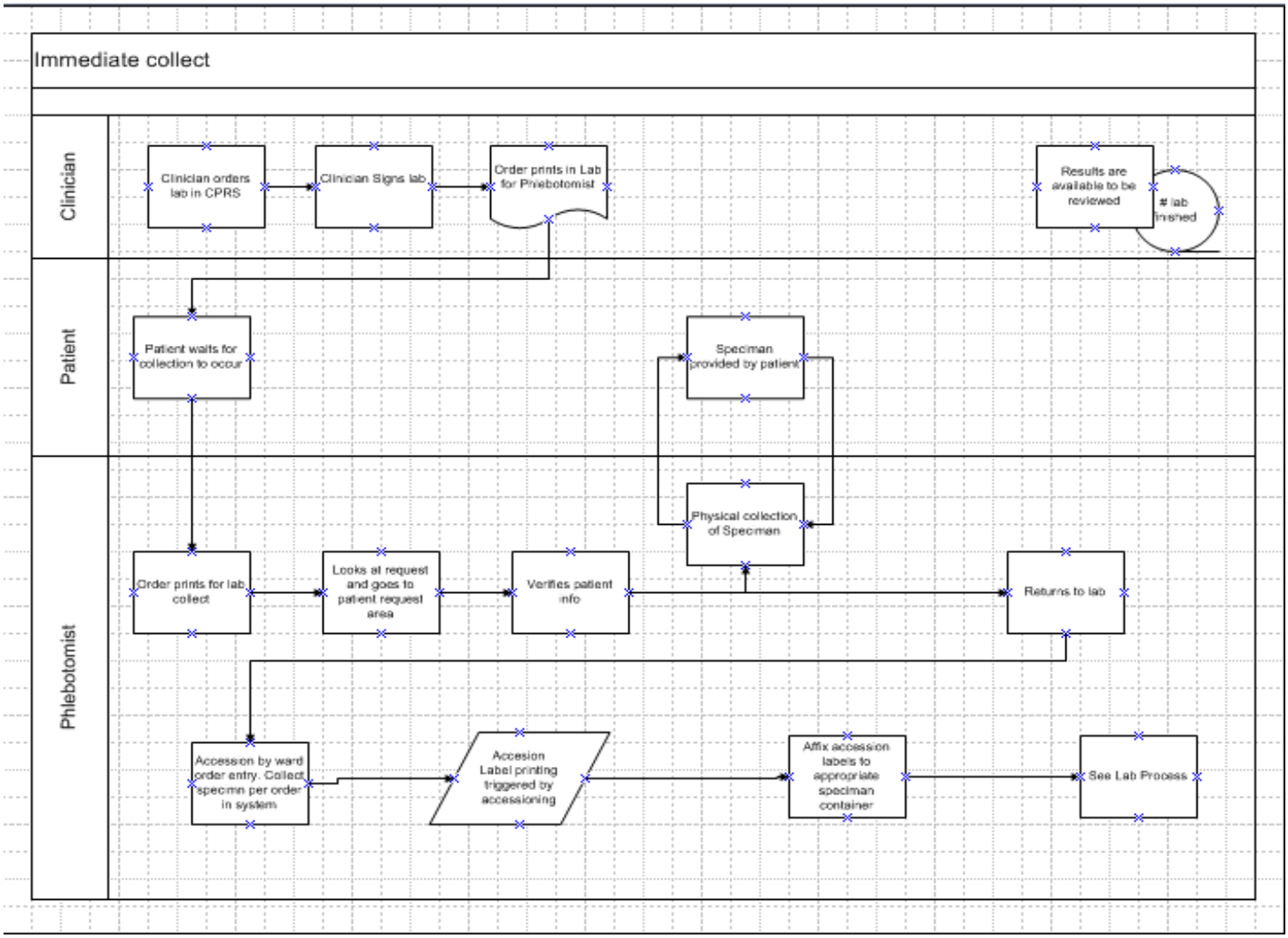


FIGURE 8 - SCREEN SHOT OF LAB COLLECT LABORATORY WORKFLOW

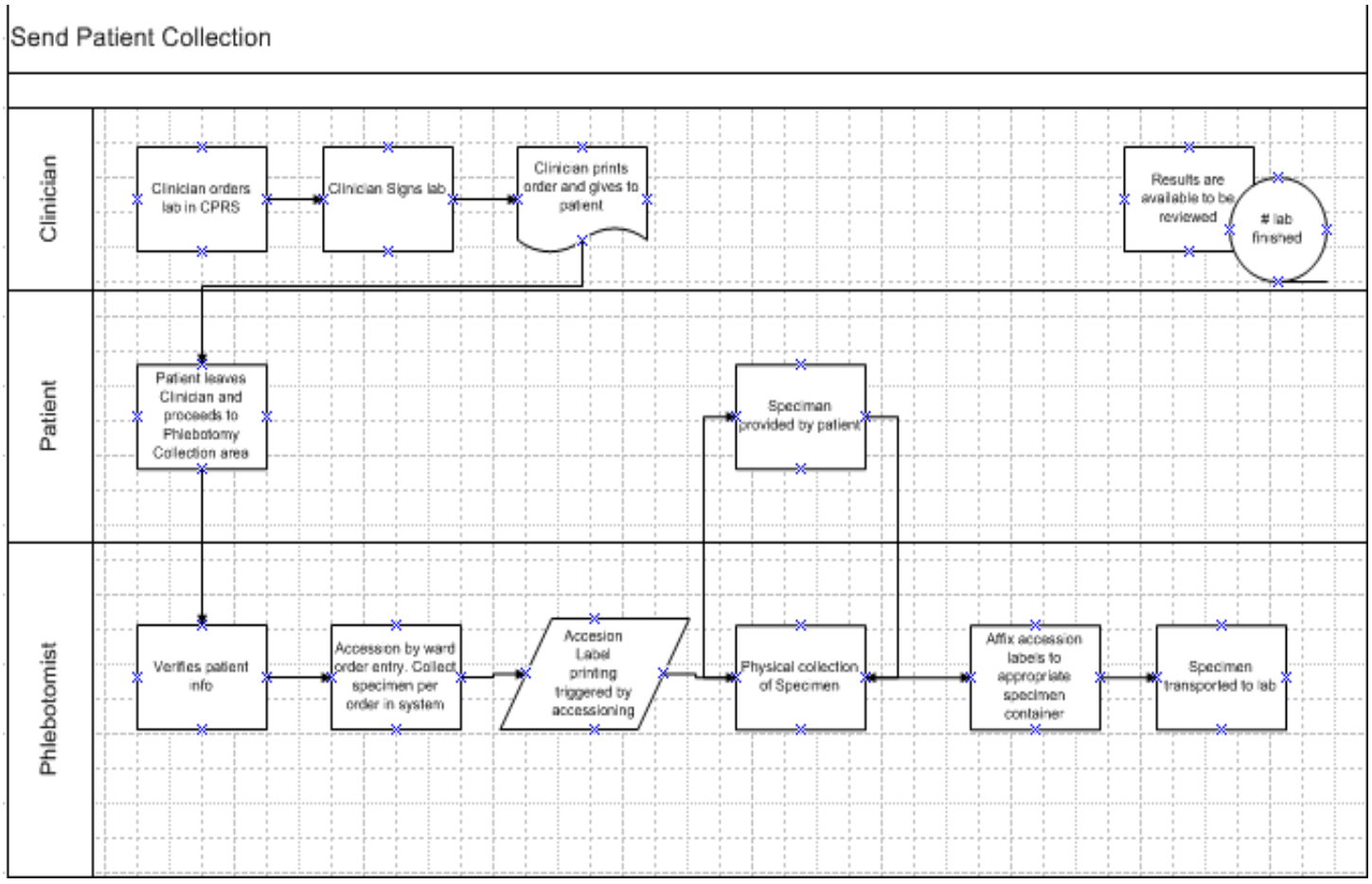


FIGURE 9 - SCREEN SHOT OPD LABORATORY WORKFLOW

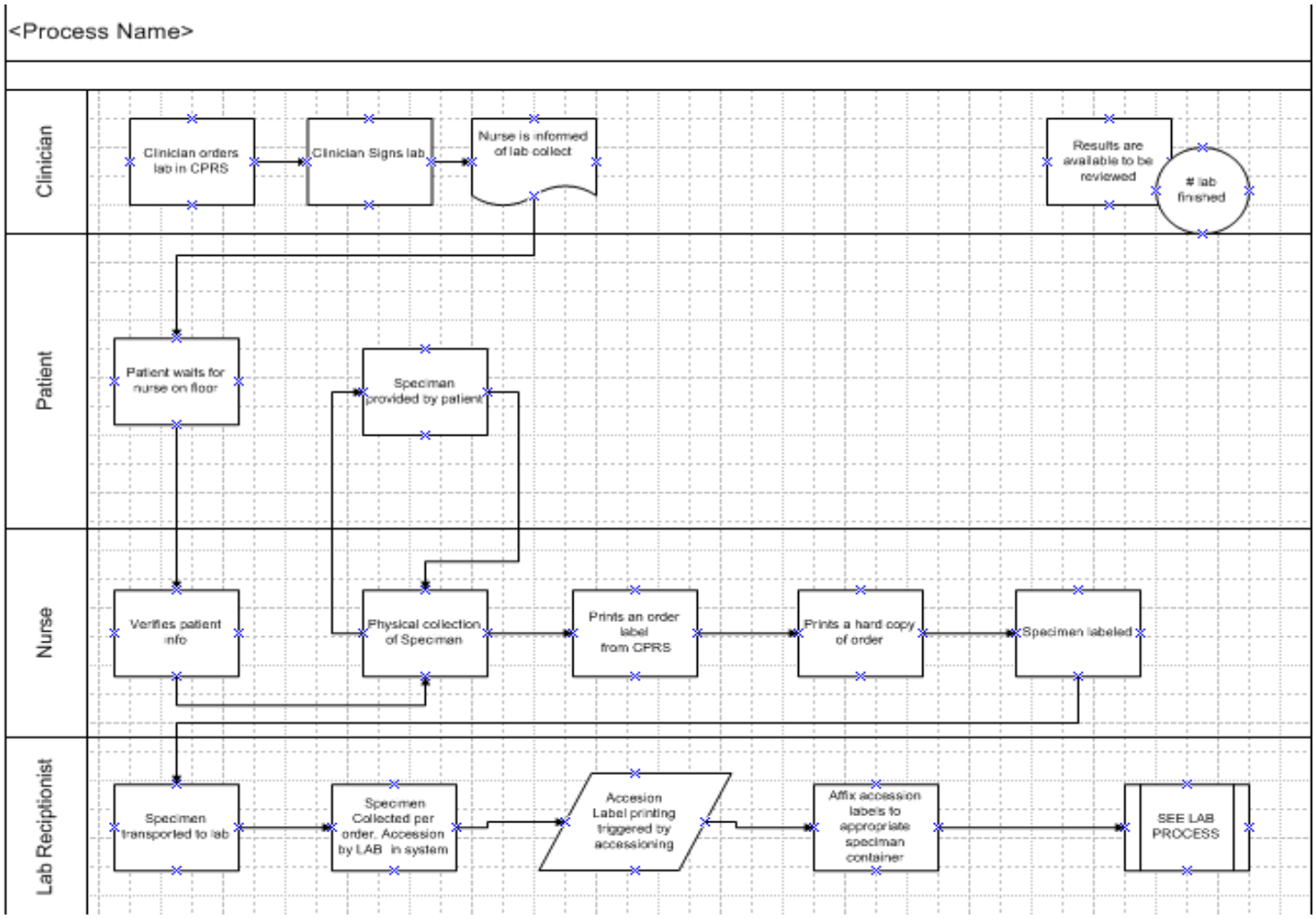


FIGURE 10 - SCREEN SHOT OF PHLEMOTOMY ROUND

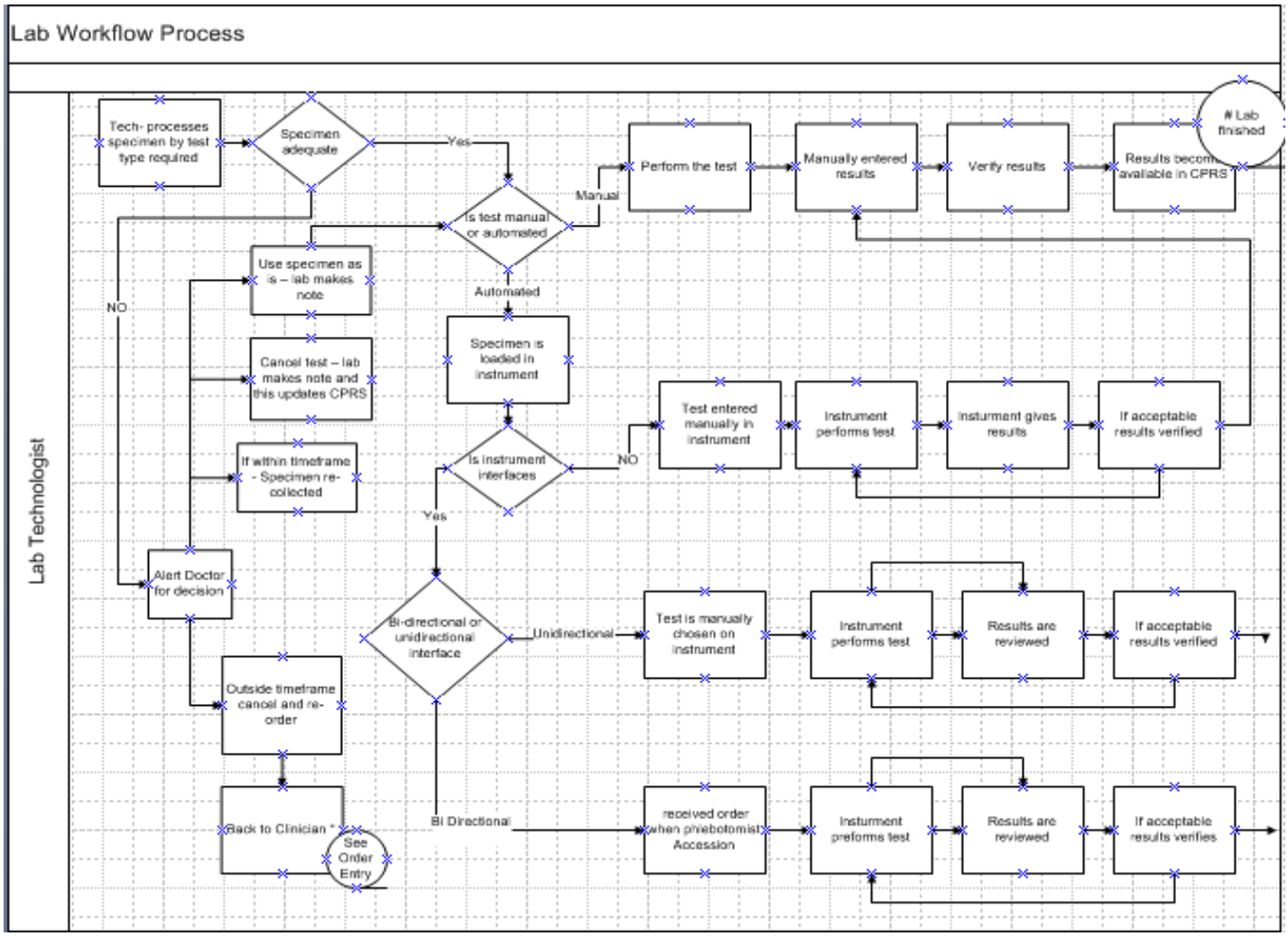


FIGURE 11 - SCREEN SHOT OF ANALYZERS INTEGRATION WORKFLOW

3.7.4 Data Collection

In this step the data which has to be there in the system, by default, for carrying out various processes of the hospital is collected. This data collection is again done by the vendors from the staff of the hospital which is working for that particular department for which the system is going to be implemented. The person from whom the data is collected should be an authorized person and should be having a complete and correct knowledge of all the data. This data is provided by the hospital in the form of worksheets called as DOW i.e. Data Object Worksheets.

For e.g. the DOW of laboratories consists of two things:

1) Individual tests
2) Profiles

INDIVIDUAL TEST DETAILS CONSISTS OF:

a) Test name
b) Synonym
c) Type (Input/output/both)
d) Department
e) Highest urgency allowed
f) Print name
g) Collection Sample type
h) Site/Specimen
i) From Age
o) Outsourced
p) Description
q) Location

j) To Age

k) Gender

l) Reference range low

m) Reference range high

n) Units

MSSH Individual tests with Test IDs.xls [Compatibility Mode] - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Test Name (individual tests)	Synonym	Type: Both, Input Output,	Department	Highest Urgency allowed	Print Name	Collection Sample Type	Site Specimen (e.g. blood, serum, urine etc)	From Age	To Age	Gender	Reference Range Low	Reference Range High	Units	Description	OutSourced	Location
2	1,25 Dihydroxy Vitamin D level		Both	Referral	Stat	125 VTD	Yellow Top	Serum	0	0		39	193	pmol/L			
3	5-HIAA,24Hrs Urine (L)	5HIAA	output	Referral	Stat	HIAA24U	Urine	Urine	16	100		0.7	8.2	mg/24 hrs			
4	Acid Phosphatase (L)	ACP	Both	Referral	Stat	ACIDPHO	Yellow Top	Serum	0	0		0	6.6	U/L			
5	ACTH, Plasma (L)		Both	Referral	Stat	ACTH, Plasma (8-10 a.m.)	Lavender Top	Whole blood	0	0		0	46	pg/mL			
6	Aldosterone, Serum (L)		Both	Referral	Stat	ALDOS	Yellow Top	Serum	0	0		25	315	pg/mL			
7	Alkaline Phosphatase Bone Specific (L)		Both	Referral	Stat	ALPBONE	Yellow Top	Serum	0	0		14.2	42.7	U/L			
8	Alpha-1-Antitrypsin Quantitation		Both	Referral	Stat	AL1ANTI	Yellow Top	Serum	0	0		90	200	mg/dL			
9	Amiodarone (L)		output	Referral	Stat	AMIODAR	Yellow Top	Serum	0	0		0.5	4.6	ug/ml			
10	APC-R (Activated Protein C		Both	Referral	Stat	APC-R	Yellow Top	Serum	0	0		0	0	sec			
11	Arsenic, Blood (L)		Both	Referral	Stat	ARSENIC	Yellow Top	Serum	0	0		2	23	ug/L			
12	Arsenic, Random Urine (L)		Both	Referral	Stat	ARSENU	Urine Container	Urine	0	0		1	35	ug/L			
13	Beta-2-Microglobulin, Urine (L)		Both	Referral	Stat	BETA U	Urine Container	Urine	0	0		5	154	ug/L			
14	Beta-2-Microglobulin,Serum (L)		Both	Referral	Stat	BETA 2	Yellow Top	Serum	0	0		510	1470	ug/L			

FIGURE 12 - SCREEN SHOT OF A DOW (DATA OBJECT WORKSHEET) FOR INDIVIDUAL TESTS IN LABORATORY

PROFILE DETAILS CONSIST OF:

1) Panel/Profile name

2) Synonym

3) Type: both/input/output

4) Highest urgency allowed

5) Print name

6) Collection sample type

7) Tests that are part of the panel

8) Ward remarks

[redacted]rofiles.xls [Compatibility Mode] - Microsoft Excel

	A	B	C	D	E	F	G	H	I
1	Panel / profile Name (Panel tests)	Synonym	Type: Both, Input Output,	Highest Urgency allowed	Print Name	Collection Sample Type	Tests that are part of panel / profile	Ward Remarks	General Ward instructions
2	Serum Electrolytes	Electrolytes	Input	STAT	SE	Yellow Top	Sodium	Do not delay the sample to send to lab after collected.	
3							Potassium		
4							Chloride		

FIGURE 13 - SCREEN SHOT OF THE DOW FOR LABORATORY PROFILES

3.7.5 Data Verification

After the completion of the data collection process, the data is verified by a person who has got a thorough knowledge of the subject. Domain expert is the most important person who checks and verifies the data. Various points that are taken into consideration by this domain expert are:

a) The lengths of the fields are apt or not.

b) The panel enlists of all the tests it should have.

c) The data type is correct or not for e.g. test name in alphanumeric and test I.D in numeric.

d) The collection sample which details about the container the sample is going to be collected in is correct or not for e.g. all urine samples are collected in sterile plastic cup.

e) The reference high and reference low ranges are correctly mentioned or not.

f) The unit to measure enzymes, hormone or chemical is as per the standards or not.

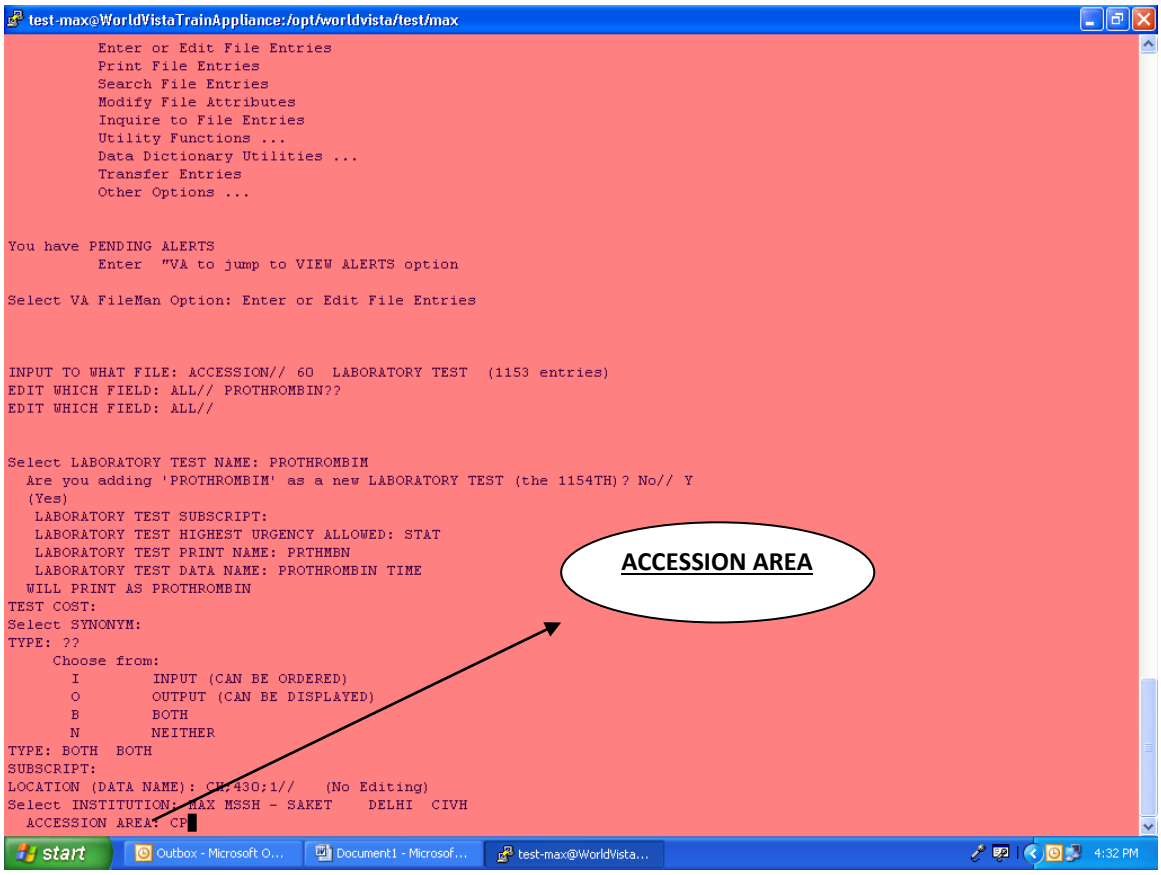
g) Usability and authenticity of the data is also checked in this step.

h) It is noted that all mandatory fields are properly and correctly filled.

3.7.6 Configuration Of The System

Once the data is verified by the domain expert, this information is then configured into the system so as to make it available for patient /admin related transactions. The configuration of the system is a step wise process in the laboratory. The data configured into the system is interlinked at instances. The order of configuration is:

a) Hospital (facility) is configured in PIMS (patient information management system).
b) Accession area
c) The site/specimen
d) Collection sample
e) Data name
f) Tests (individual tests)
g) Tests (Profiles)



ROLL AND SCROLL SCREENSHOT

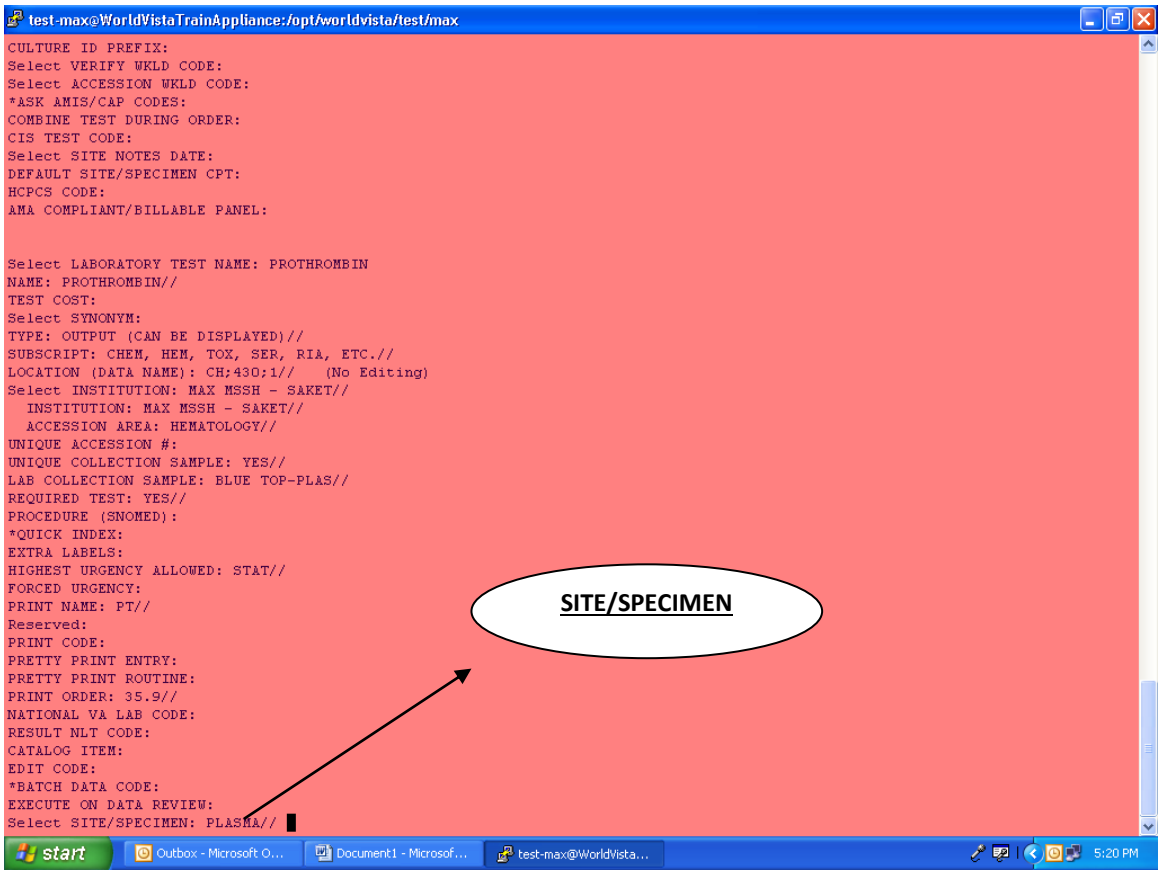


FIGURE 14 - ROLL AND SCROLL

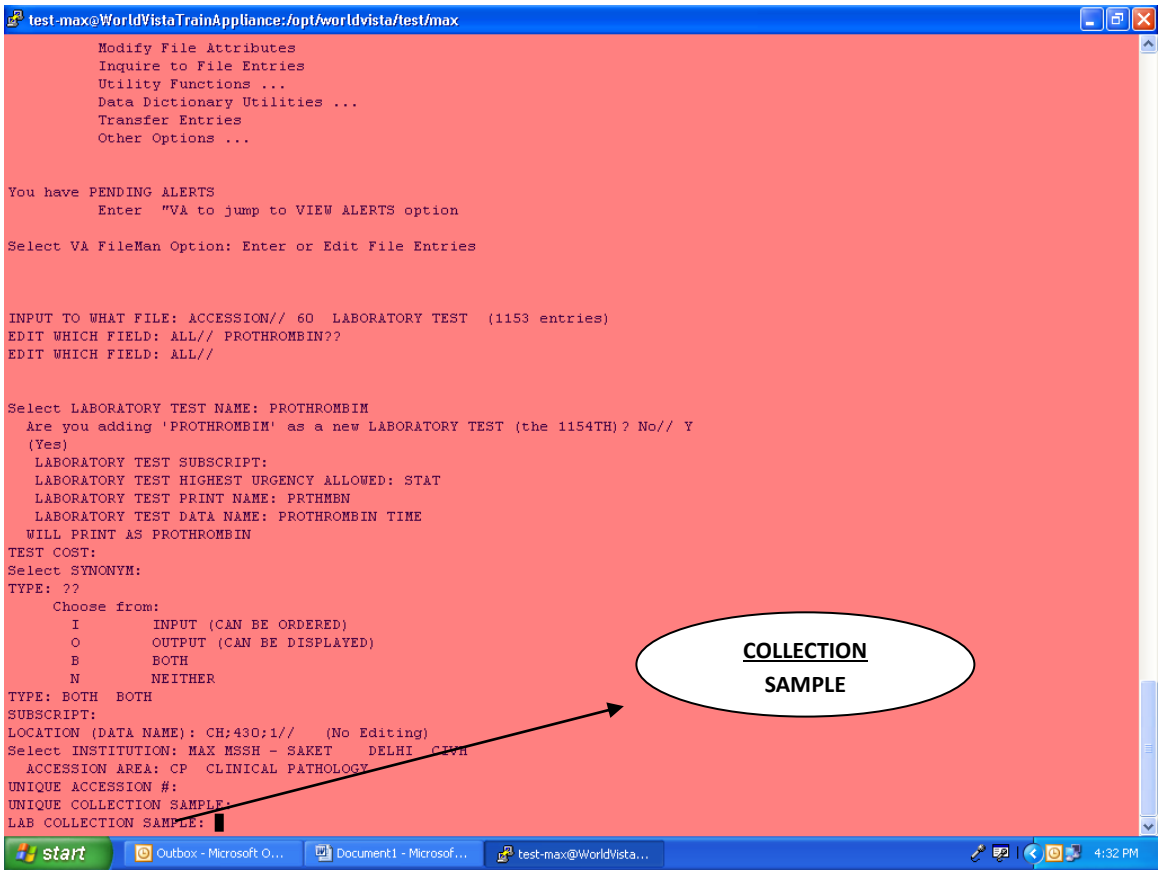


FIGURE 15 - ROLL AND SCROLL SCREENSHOT

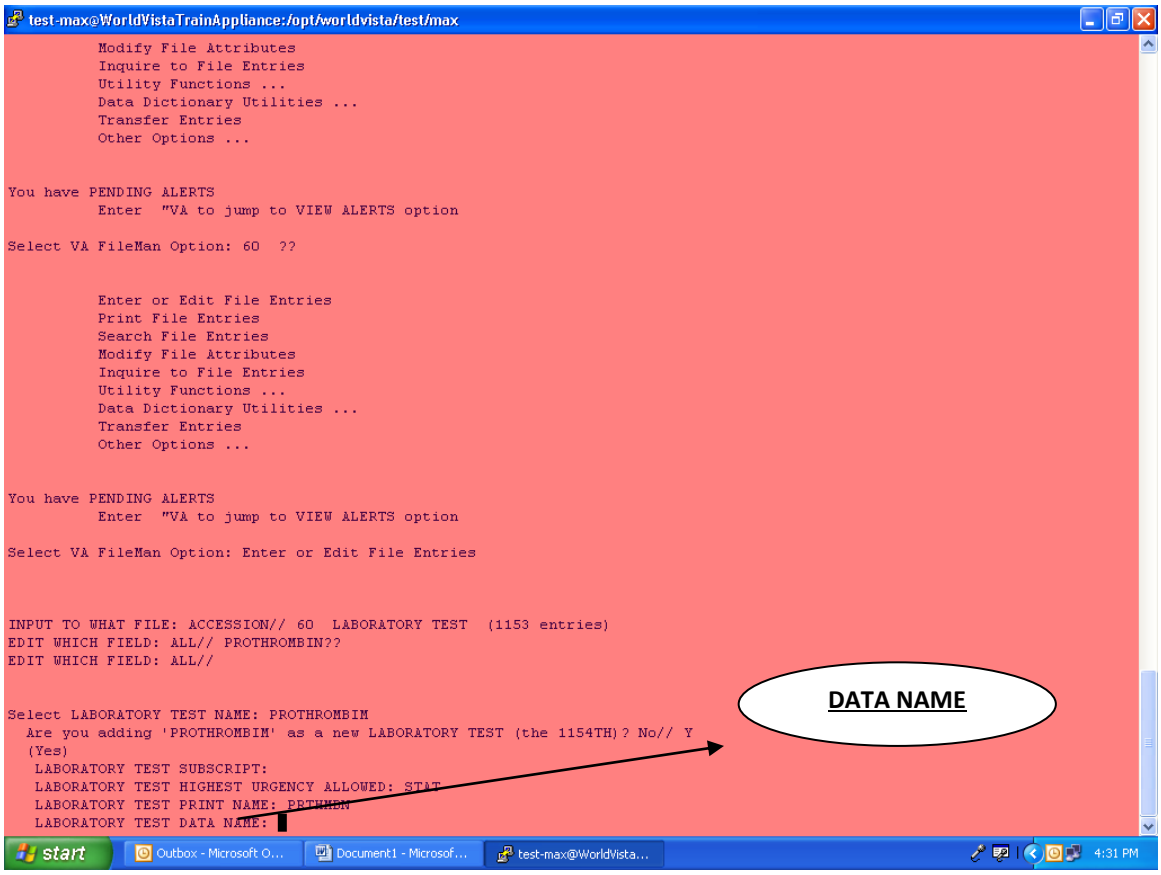


FIGURE 16 - ROLL AND SCROLL SCREEN SHOT

FIGURE 17 - SCREEN SHOT OF THE CONFIGURATION PROCESS

a) **LABORATORY DEPARTMENT**: first of all, PIMS (Patient management information system) which provide the basic frame work of the entire hospital, will configure laboratory department in the system

b) **ACCESSION AREA**: Laboratories Services are established with a view to provide wide range of Laboratory investigations, necessary for patient care. It consists of disciplines of Biochemistry, Clinical Pathology, Hematology, Immunology, Microbiology & Serology, Histopathology, Cytopathology and Immuno-Histo chemistry also known as accession area. All these disciplines provide qualitative and quantitative analysis of biological fluids such as blood, serum or plasma, tissue, urine, stool, CSF etc., for specific constituents to support Clinicians in the practice of medicine. The accession areas are equipped with state-of-the-art equipments.

c) **COLLECTION SAMPLE**: collection sample indicates the container in which the specimen has to be taken and tested in, the options of collection sample are:

1) Bottle
2) Sterile tube
3) Sterile container
4) Urine cup
5) Culture swab
6) Vacutainer

d) **SITE/SPECIMEN**: This part of the configuration defines the kind of specimen taken for examination. It gives an option to choose from whole blood, serum, plasma, tissue, urine, stool, CSF etc and based on the type of specimen required for particular pathology or diagnosis the specimen is chosen.

e) **DATA NAME**: Configuring a data name is important for the reporting purposes. It is configured to get a comprehensible display in the report.

3.7.7 Training Of The End Users And The Super Users

After the system is ready in terms of system (desktops, printers, scanners etc) and application, to make it useable by the users, training is held.[6.9] To make the work easier and the directions to use the systems more readily available, a training manual is made with the help of the documentation team.

Consultants make training manuals differently for the users and the super users and manuals are made department wise i.e. to train a particular group of people for laboratory and particular group for radiology module and likewise.

Trainings are scheduled with the help of the training team, which is responsible for the schedule planning, choosing the super users and exclusive training to them, the arrangement of infrastructure that is required for the training, and this team also ensures the quality of the user manuals.

dept	category	No. of end users					super user					
		cprs	radio	lab	pharma	surgery	cprs	radio	lab	pharma	surgery	
	3848	2346	474	551	57	420	129	26	30	4	38	227
accident	physician	10				10	1	0	0	0	1	
Anesthesia	Physician	25				25	1	0	0	0	1	
Anesthesia	Paramedic					27	0	0	0	0	1	
Cardiac Sciences	Physician	19				19	1	0	0	0	1	
Cardiac Sciences	Paramedic					47	0	0	0	0	2	
Cardiac Sciences	Support	2				2	1	0	0	0	1	
Critical Care	Physician	15				2	1	0	0	0	1	
Dentistry	physician	1				1	1				1	
Dentistry	Paramedic					7					1	
Endocrinology	Physician	3										
Facilities Management	Front office		403	403			0	20	20	0	0	
Gastroentrology	physician	2										
General Medicine	physician	18										
Home Care	nursing	15										
IVF	nursing	2				2						
IVF	Paramedic					2						
Lab Services	Physician	11					1	0	0	0	0	
Lab Services	Paramedic			142			0	0	7	0	0	
Lab Services	Support			2			0	0	1	0	0	
Medical Administration	Physician	5					1	0	0	0	0	
Medical Administration	Front office		3	3			0	1	1	0	0	

FIGURE 18 - SCREEN SHOT SHOWING THE USERS AND SUPER USERS TO BE TRAINED

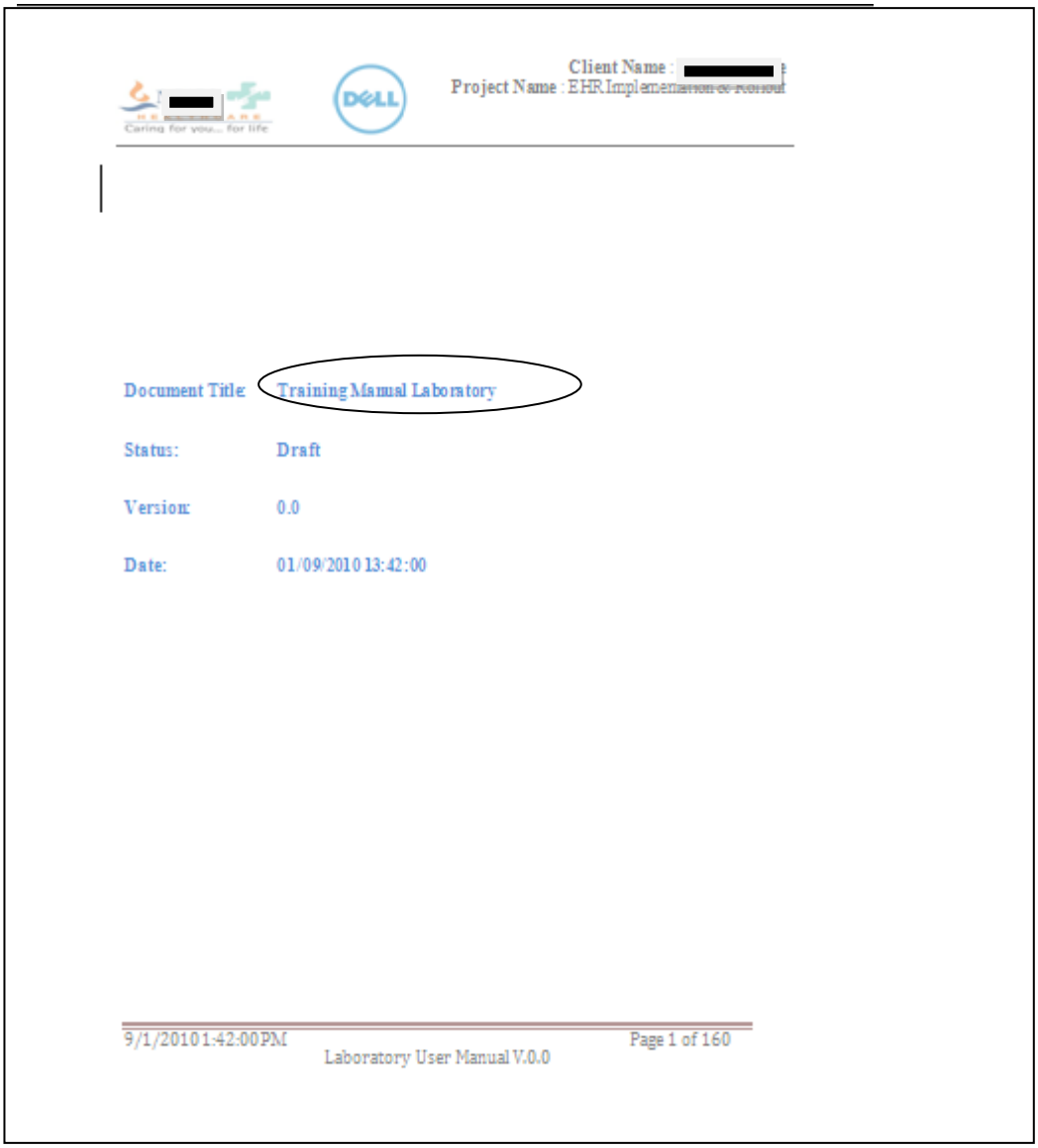


FIGURE 19 - SCREEN SHOT OF LABORATORY TRAINING MANUAL

3.7.8 User Acceptance Test

After the users are fully trained in using the various modules which they are supposed to, then a user acceptance test is taken, just to ensure that the system is totally compatible and easy to use by the staff of the hospital. A series of hypothetical test case scenarios are built by the super users and the understanding and acceptability of the users are checked with the help of these scenarios, these cases help us check the knowledge of both the users as well as the super users since they are the ones who design the scenarios.

The case scenarios include different flows of the system and work just to ensure that the system behaves the way it is expected to.

One sample user acceptance scenarios is:

MODULE	TEST CASE I.D	SCENARIO DESCRIPTION	PRE-REQUISITES	PRE-CONDITIONS	ACTION STEPS	ACTORS	POST CONDITIONS	RESULTS	REMARKS FROM THE CLIENT	SATISFACTION LEVEL	REMARKS FROM DELL
LAB	L-BC-0023	THE TECHNOLOGIST WANTS TO FEED IN THE RESULTS OF 12 TESTS ALTOGETHER IN ONE GO	THE SAMPLES SHOULD BE FOR THE SAME TEST	THE SAMPLES SHOULD BE FOR ACCESSIONED AND THE RESULTS SHOULD BE THE SAME FOT ALL THE TESTS	LAB MENU----→PROCESS DATA IN LAB MENU-→BATCH DATA ENTRY	TECHNOLOGIST	THE RESULTS SHOULD BE DISPLAYED FOR ALL THE TESTS.	RESULTS STUFFED IN ONE GO FOR ALL THE TESTS		LEVEL 1-HAPPY LEVEL2-SATISFACTORY LEVEL 3-UNSATISFIED	BASED ON THE 3 SCENARIONS 1)CLIENT HAPPY-NO REMARKS 2)CLIENT SATISFIED-REMARKS FROM DELL 3)CLIENT UNSATISFIED-REVIEW OF THE SYSTEM

FIGURE 20 - SCREEN SHOT FOR A USER ACCEPTANCE SCENARIO

ABOVE SCENARIO:

The above scenario is when a technician tests 12 similar samples gets the same result, and he now wants to enter these results all at one once in the system for all the tests.

1) The module for this scenario is that of laboratory.
2) The test case I.D no. is for lab and is from biochemistry hence L-BC.
3) The scenario description is the same as our case i.e. technician wants to stuff in the result for all the same tests in one go.
4) Pre requisites are:

a) The samples should be for the same tests.

5) Pre conditions are:
   a) The samples should be accessioned.
   b) The samples should be having the same results.

6) Action steps are the series of events which are completed before the entry of the results into the system.
7) Actors are the people who are a part of the entire process, here there is just one actor i.e. the technologist.
8) Post conditions are the conditions which can be identified once the process is completed.
9) Results are as per the scenarios, like in this case one of the results could be stuffing of the results in the systems all together.
10) When the process is completed the remarks are taken by the client in his own words.
11) Thereafter the satisfaction level of the client is checked wherein there are 3 satisfaction levels, level 1 is that the client is happy with the system; level 2 is that the client is satisfied with the system and level 3 is that the client is unsatisfied with the system.
12) Remarks from the company are also given on the basis of the kind of the response received by the client, if the client is happy with the system then company gives no remarks, if the client is satisfied, remarks are written by the company such that to make the system even more client friendly, and in case the client is totally unsatisfied the entire system is reviewed so as to find out the loopholes and correct them and develop a robust, user friendly system.

3.7.9 Go Live

The go live stage of any software or application rollout is the most crucial part of the business. This is the make or break phase that could define the immediate future of the business and it requires a totally error-free solutions for this. Complex application with even minor probability of error can bring down reliability during user acceptance and the “go-live” stage. Countering these factors requires a structured methodology for a test plan, test environment, verification and execution.

This phase of the implementation project is concerned with supporting and optimizing the operating system, both technical infrastructure and load distribution as well as the business processes.

Checklists for all the setups and all the configurations are made and all the tests, panel and their configurations are checked.

After ensuring this the “Green Flag” is given to the project which symbols that now the application is all set to go-live in the real environment.

3.7.10 Integration With The Analyzers

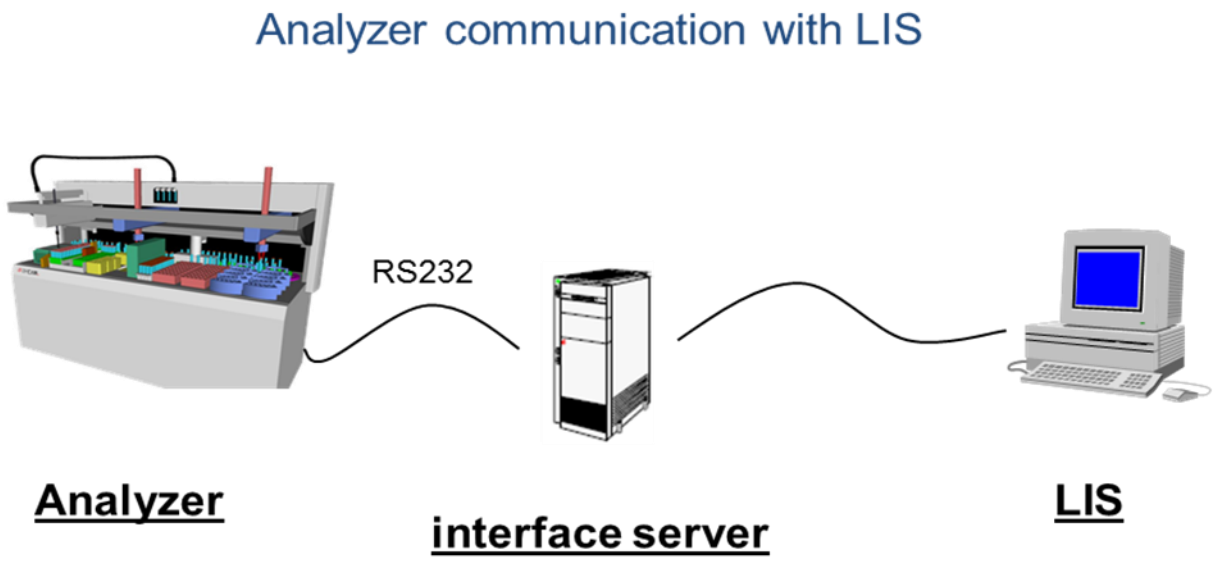


FIGURE 21 – ANALYZERS COMMUNICATION WITH LIS

The transmission mode in Analyzer

a). Unidirectional

b). Bi-Directional

In Unidirectional mode results only will be receiving from the Analyzer. In Bi-directional mode test-requests order will be placing to the Analyzer and Analyzer in turn will process the specimen for the requested tests and will return the results when they are ready. The transmission mode will depend on the manufacturer and the model of the Analyzer. In order to communicate between HOST and the Analyzer certain parameters have to be set on the Analyzer. The mechanism of connectivity is as follows. The Analyzer is connected to a computer by a data cable prepared in accordance with the specifications given by the vendor of the Analyzer. In the computer that is connected with the Analyzer a program will be running continuously to receive and send the data from Analyzer to HOST.[6.8]

Connection modes with Analyzers

- RS232 Serial Port Connection
- TCP/IP connection
- Hybrid connection

RS232 Serial port connection

The serial port is an I/O (Input/Output) device. An I/O device is just a way to get data into and out of a computer. There are many types of I/O devices such as serial ports, parallel ports, disk drive controllers, Ethernet boards, universal serial buses, etc. Most PC's have one or two serial ports. Each has a 9-pin connector (sometimes 25-pin) on the back of the computer. Computer programs can send data (bytes) to the transmit pin (output) and receive bytes from the receive pin (input). The other pins are for control purposes and ground.

RS232 follows the below protocols:

1) Application Layer
2) Presentation layer
3) Data link layer
4) Physical layer

Limitations

- Cable length should be maximum 15 meters, or else noise will occur in transmitting data.
- Windows OS will support maximum 4 serial port for one PC.

Setup for RS232,

Following parameters are required for interface server to communicate with analyzer.
There are baud rate, stop bit, parity bit, data bits
Port No - which port is going to bind for communication
Baud rate-Data flow per second
Data bits - Length of data bits
stop bits - Number of stop bit in data bit
Parity bit- For Error checking Parity details.

TCP/IP connection

Transmission control protocol and internet protocol . It is used on LAN, WAN.

TCP/IP communication is following 7 layers protocol

1) Application
2) Presentation
3) Transmission
4) Network
5) Control
6) Data link
7) Physical

3.8 Challenges In The Implementation Of Vista Laboratory Information System

1) Features which were absent in the application, but were compulsorily required by the client.
2) New requirements which were emerging at the time of site assessment, and were not present in the application.
3) Mapping of the workflows, there were different workflows being practiced in the different branches of the client hospital, but for the proper use of the application a unique workflow was to be used, commonly.
4) Difference in workflow between application and the workflows being currently used.
5) Getting accurate and complete lab data for all the branches, that was to be sorted and configured in Vista, deletion was to be done of the junk data on grounds like duplication, multiple tests with multiple specimens.
6) Writing of the scenarios to test the usability of the application, before actually implementing the application.

4.0 Results

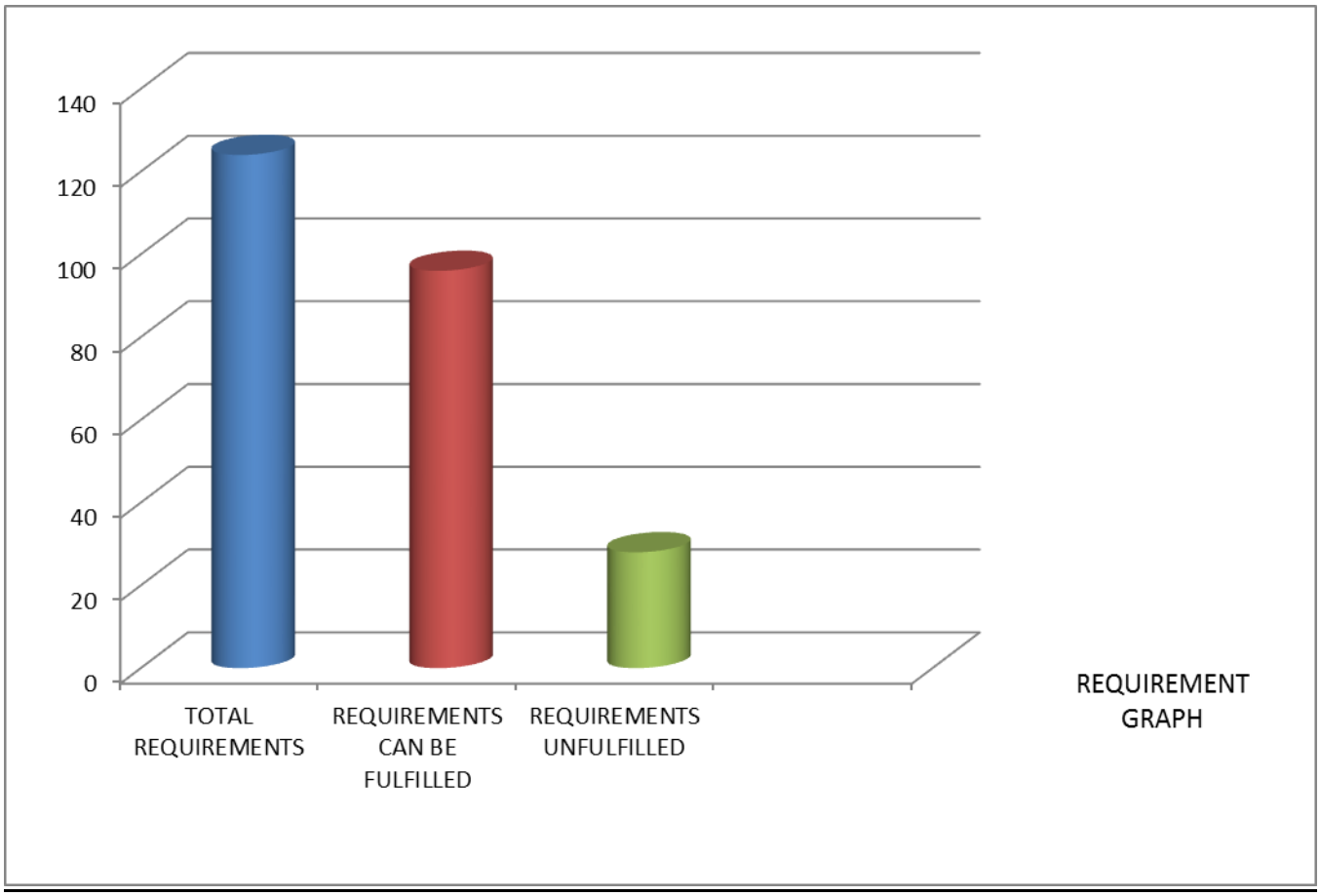


FIGURE 22 – REQUIREMENT GRAPH

As shown in the graph above:

There were 124 business requirements of the client out of which, after implementation of this application 98 could be fulfilled and 26 were out of the scope of Vista. This implies that the application is able to fulfill approximately 80 percent of the client's needs.

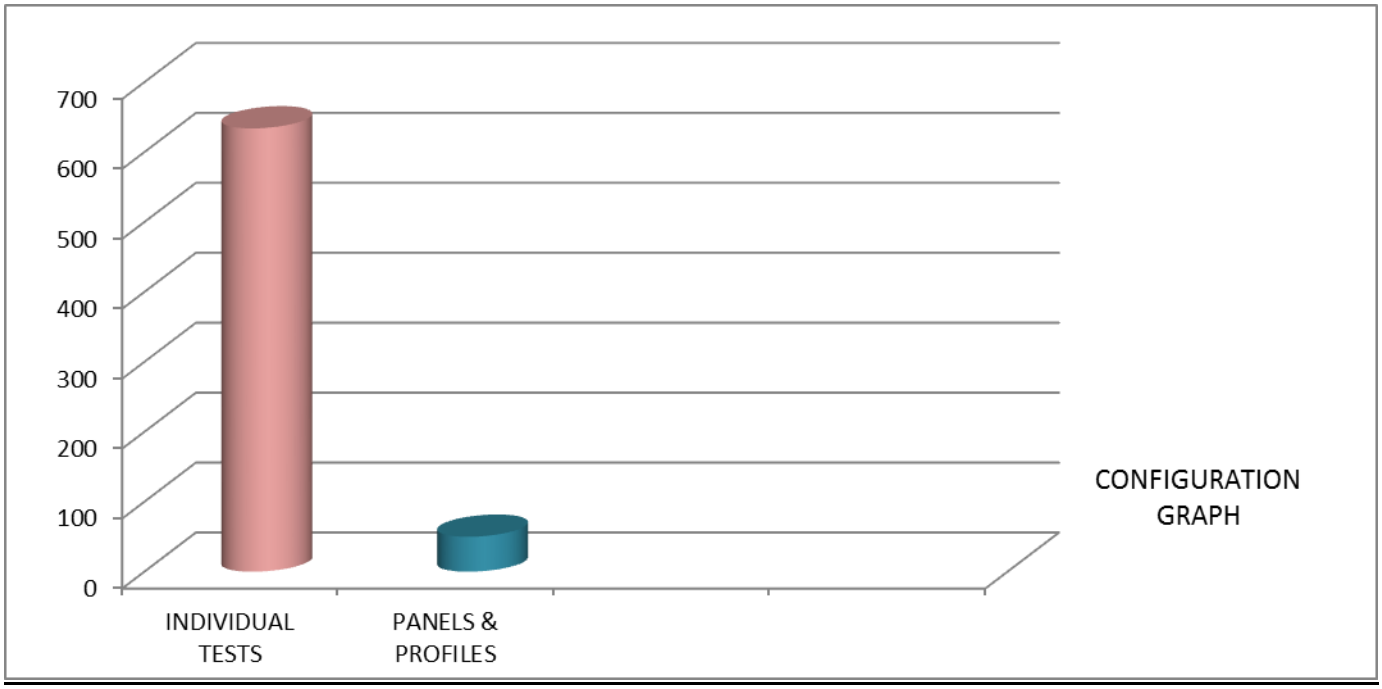


FIGURE 23 – CONFIGURATION GRAPH

As shown above there were a total of 684 tests and panels which were configured, out of which 634 were individual tests and 50 panels of various tests.

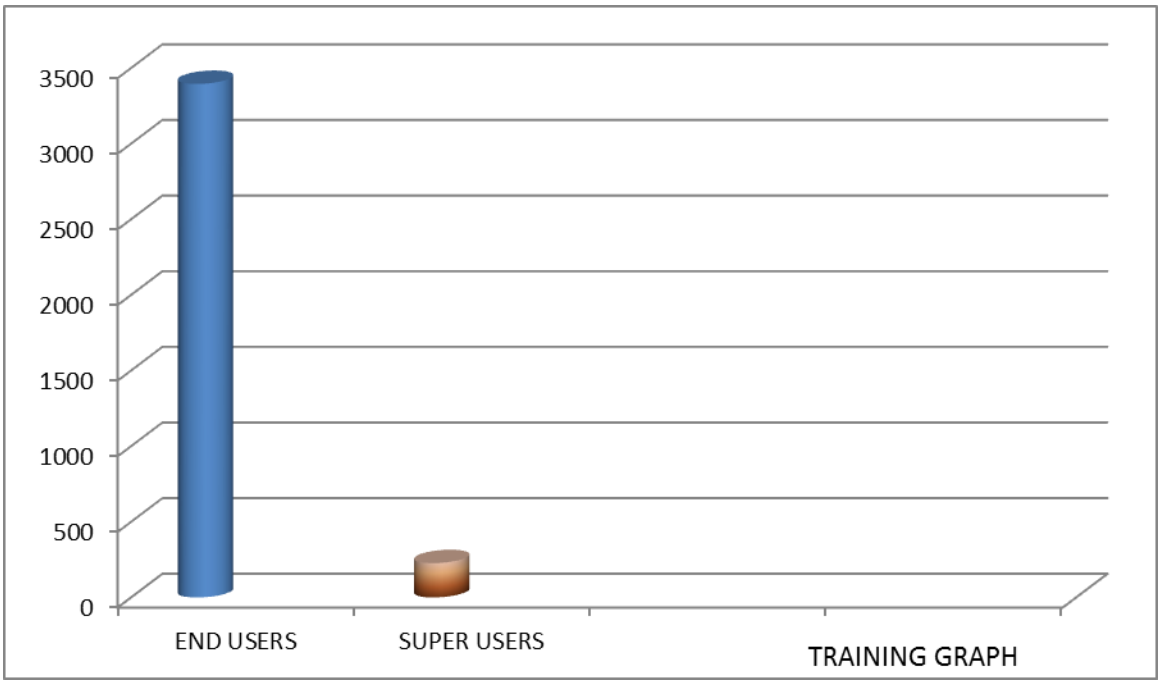


FIGURE 24 – TRAINING GRAPH

There were 3395 end users and 227 super users to be trained in all the 8 client's hospitals

5.0 Discussion

Amongst the multitude of reasons driving healthcare laboratory automation, these can be broadly classified as internal and external drivers. Internal drivers are those emanating from within the organization as a response to operational challenges, quality initiatives and organizational drive. External drivers come about as a result of market competition, customer expectations and regulatory requirements.[6.7]

Quality pushes the adoption of information systems for reasons like parameterization, data acquisition, aggregation and analysis, performance measurement and monitoring. Parameters like time of action, reasons for delay in discharge process are measured at the point of action and analyzed over a period of time to uncover the process & operational inefficiencies and then be able to optimize it.

Monitoring of operational cost is mandatory for any organization to be able to survive in the competitive environment. This requires an Information System to be in place to support a secure way of handling transactions, store data and present information in an analyzable format. Audits (accounting, process, clinical etc.) depend on this data for assessing the state of affairs and finding gaps or loopholes, with an opportunity to improve the systems & processes.

Efficient utilization of organizational resources is promoted through resource planning which is brought about by the visibility of enterprise wide process and information. Trawling through the information systems, the operational reports capture the slackness in the processes and allow for constant monitoring. Once this information becomes available, the decision makers are empowered to take objective & informed decisions, thereby resulting in measurable performance improvement.

Healthcare today finds itself at crossroads facing three major moving targets:

- Cost
- Access
- Quality

For healthcare to be sustainable and be able to meet the patient's requirements, it has to be cost efficient & provide access to quality care. Increasingly the Information Systems are called upon to support these objectives. The benefit of Information Systems adoption in achieving these objectives flows from the following

- Time - Real time flow of information
- Place - Remote dissemination of information
- Standardization - Processes & Workflows
- Coordination -Among care providers
- Decision support – Clinical knowledgebase, Clinical pathways & protocols
- Retrospective analysis – Trends, audits, outcomes
- Predictive analysis – What-if, simulation & modeling

Hence with the implementation of VistA EHR the client will be able to meet its said objectives to a larger extent and be self sufficient in carrying out its operations.

5.1 Conclusion

Implementation of LIS is a very profitable and advantageous practice for both hospitals as well as the Patients, but it is not cake-walk, it needs a deep understanding of the pre implementation & post implementation stages, the specific requirements of all these phase, the pros and cons of all the stages.[6.11,6.12]

Service provider has to ensure that sufficient time is spent at the beginning of the project on understanding the objectives, deliverables and scope of the project.

The above study helps us to have a clear analysis of the various steps which are very important and should be kept in mind before buying an LIS for implementation.

The results of the study help us determine all the factors one should keep in mind, before implementing an application like here.

80 percent requirements were being fulfilled after the implementation of the application, rest 20 percent should be weighed on the basis of their priority and the application should be implemented, on the basis of this or any additional application could be bought to take care of the rest 20 percent.

There is a large number of tests and profile which are needed to be configured in the application as per the client hospital's requirement, so this also has to be checked if the application supports such huge numbers being configured and made default for the staff. Like in this case the application does support the number of tests and profile the client hospital needs.

Since there is large number of users, of this application, which includes every kind of staff, so this application is expected to be highly user friendly so that this may be totally functional and acceptable by all of them.

5.2 Recommendations

A careful understanding, verification and validation of the requirements of the client in the pre implementation stage, is a major recommendation so as to make the implementation of the application a success.

A team of knowledgeable technologist should be made so as to make the application totally compatible with the need of the hospital with the maximum possible requirements being satisfied.

The client should provide the vendor with a suitable and authentic point of contact who has the knowledge of the laboratory as well as can understand the application to a level such that the data collection and verification can be done accurately and completely.

Training team should be knowledgeable, empathetic and cooperative so that they can share proper lessons about the application without making it appear a difficult transformation.

A strong, dynamic and knowledgeable team should be built for the go-live stage, which can take the entire responsibility of the application, its working and which can act spontaneously if the hospital staff faces any hurdle.

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7.0 Appendix

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	HIS Test ID	Test Name (individual tests)	CPT Code	Synonym	Type: Both, Input Output,	Department	Highest Urgency allowed	Print Name	Collection Sample Type	Site Specimen (e.g. blood, serum, urine etc)	From Age	To Age	Gender
2	6286	1,25 Dihydroxy Vitamin D level (L)			Both	Referral	Stat	125 VTD	Yellow Top	Serum	0	0	
3	21739	5-HIAA,24Hrs Urine (L)		5HIAA	output	Referral	Stat	HIAA24U	Urine	Urine	16	100	
4	5864	Acid Phosphatase (L)		ACP	Both	Referral	Stat	ACIDPHO	Yellow Top	Serum	0	0	
5	6386	ACTH, Plasma (L)			Both	Referral	Stat	ACTH_Pla	Lavender Tc	Whole blood	0	0	
6	6253	Aldosterone, Serum (L)			Both	Referral	Stat	ALDOS	Yellow Top	Serum	0	0	
7	6501	Alkaline Phosphatase Bone Specific (L)			Both	Referral	Stat	ALPBONE	Yellow Top	Serum	0	0	
8	25558	Alpha-1-Antitrypsin Quantitation (L)			Both	Referral	Stat	AL1ANTI	Yellow Top	Serum	0	0	
9	26311	Amiodarone (L)			output	Referral	Stat	AMIODAR	Yellow Top	Serum	0	0	
10	25565	APC-R (Activated Protein C Resistance) (L)			Both	Referral	Stat	APC-R	Yellow Top	Serum	0	0	
11	26295	Arsenic, Blood (L)			Both	Referral	Stat	ARSENIC	Yellow Top	Serum	0	0	
12	26294	Arsenic, Random Urine (L)			Both	Referral	Stat	ARSENU	Urine Conta	Urine	0	0	
13	6512	Beta-2-Microglobulin, Urine (L)			Both	Referral	Stat	BETA U	Urine Conta	Urine	0	0	
14	25566	Beta-2-Microglobulin,Serum (L)			Both	Referral	Stat	BETA 2	Yellow Top	Serum	0	0	
15	26389	Biotinidase Newborn Screen (L)			Both	Referral	Stat	BDN	Green Top	Plasma	1	14	
16	26385	C1 Esterase Inhibitor, Functional Activity (L)			Both	Referral	Stat	C1EIFA	Yellow Top	Serum	0	0	
17	26386	C1 Esterase Inhibitor, Protein Quantitation (L)			Both	Referral	Stat	C1EIPQ	Yellow Top	Serum	0	0	Female
18											0	0	Male
19	19574	Calcitonin, Serum (L)			Both	Referral	Stat	CALCITO	Yellow Top	Serum	0	0	
20	6357	Ceruloplasmin (L)			Both	Referral	Stat	CERULO	Yellow Top	Serum	0	0	
21	26450	Cholinesterase (L)			Both	Referral	Stat	CHOLIN	Yellow Top	Serum	0	0	
22	28680	Chromoganin A, EDTA (L)			Both	Referral	Stat	CHROMA	Yellow Top	Serum	0	0	
23	27986	Cystatin C (SR)			Both	Referral	Stat	CystatC	Yellow Top	Serum	0	0	
24	6443	Gastrin (L)			Both	Referral	Stat	Gastrin	Yellow Top	Serum	0	0	
25	24193	Lactate, Plasma (L)			Both	Referral	Stat	LACTATE	Yellow Top	Serum	0	0	
26	24194	Lactate,CSF (L)			Both	Referral	Stat	LAC CSF	Sterile Cup	CSF	0	0	
27	6549	Lead Level Blood (L)			Both	Referral	Stat	LEAD	Yellow Top	Serum	0	0	
28	5924	Lithium (L)			Both	Referral	Stat	Lithium	Yellow Top	Serum	0	0	
29	26411	Mercury, Blood (SR)			Both	Referral	Stat	MERCUR'	Yellow Top	Serum	0	0	
30	6112	NSE (Neurone Specific Enolase),Serum (L)			Both	Referral	Stat	NSE	Yellow Top	Serum	0	0	

Individual tests with Test IDs.xls [Compatibility Mode] - Microsoft Excel

Glycosylated Hemoglobin	PT INR	Blood sugar - Random	Creatinine Phosphokinase Myocardium	Complete Blood Count
Lipid Profile	APTT	Serum Electrolytes	Troponine T	Total Leucocyte Count
Liver Function Test	CBC	Serum Sodium	Blood Urea	Differential Leucocyte Count
Thyroid Function Test	Blood Culture	Serum Potassium	Sr Creatinine	Thyroid Profile
Thyroid Stimulating Hormone	T3	Serum Chloride	Sr Na (Sodium)	Throid Stimulating Harmone
Hepatitis B Surface Antigen	T4	Lipid Profile	Sr K (Potassium)	Serum Parathroid Harmone
Serum B12	TSH	Apolipoprotein A1	Ril/D (Sbilurum)	URINE routine & Microscopy
Prothombin Time with INR	Urine culture	Apolipoprotein B	SGOT	Urine culture & sensitivity
Activated Partial Thromboplastin Time	Urine Microscopy	HsCRP	SGPT	Pus culture & sensitivity
Serum Electrolytes	Urine Routine	Lipoprotein (a)	Serum Albumin	Blood culture & sensitivity
Urine Routine Microscopy	Blood sugar	S.Homocysteine	Serum Globumin	
Hepatitis C Virus Anti IgG	Urine VMA	Serum Fibrinogen	A/G Ratio	
Human Immunodeficiency Virus	Serum cortisol	HBsAg	Random Blood Glucose	
Serum Iron		Anti-HCV	NT Pro BNP	
Serum Ferritin		HIV I & II	Troponine I	
Total Iron Binding Capacity		Prothrombin Time (PT)		
		Partial Prothrombin Time (APPT)		
		ACT		
		Liver function test		
		Renal function test		

QUICK ORDERS-FULL.xlsx - Microsoft Excel

LIST OF FAV LAB TESTS	TEST NAME IN VISTA	QUICK ORDER OP	QUICK ORDER IP	QUICK ORDER ER
25-Hydroxy-VitD3	25 HYDROXY VITAMIN D3 LEVEL	LRZ QO 25 HYD VITD3	LRZ QI 25 HYD VITD3	LRZ QE 25 HYD VITD3
ABSOLUTE EOSINOPHIL COUNT	ABSOLUTE EOSINOPHIL COUNT	LRZ QO AEC	LRZ QI AEC	LRZ QE AEC
Acivated Partial Thromboplastin Time	PARTIAL THROMBOPLASTIN TIME	LRZ QO PTT	LRZ QI PTT	LRZ QE PTT
ALANINE TRANSAMINASE (ALT)	ALANINE AMINO TRANSFERASE,SERUM			
albumin	ALBUMIN,SERUM	LRZ QO ALBUMIN	LRZ QI ALBUMIN	LRZ QE ALBUMIN
Alkaline Phosphatase	ALKALINE PHOSPHATASE	LRZ QO ALKALINE	LRZ QI ALKALINE	LRZ QE ALKALINE
Amylase	AMYLASE,SERUM	LRZ QO AMYLASE	LRZ QI AMYLASE	LRZ QE AMYLASE
Anti-HCV	IgM-ANTI HCV(L)	LRZ QO ANTI HCV	LRZ QI ANTI HCV	LRZ QE ANTI HCV
ASPARTATE TRANSAMINASE (AST)	ASPARTATE AMINO TRANSFERASE, SERUM			
B12 Folate Ferritin	FERRITIN			
Blood c/s				
Blood sugar - fasting	BLOOD SUGAR FASTING	LRZ QO BLD SU FAST	LRZ QO BLD SU FAST	LRZ QO BLD SU FAST
Blood sugar - PP	BLOOD SUGAR 2HR PP	LRZ QO BLD SU 2HR PP	LRZ QI BLD SU 2HR PP	LRZ QE BLD SU 2HR PP
Blood sugar - Random	BLOOD SUGAR (RANDOM)	LRZ QO BLD SU RANDM	LRZ QO BLD SU RANDM	LRZ QO BLD SU RANDM
Blood Urea Nitrogen	BLOOD UREA NITROGEN, SERUM	LRZ QO BLD UR NIT	LRZ QI BLD UR NIT	LRZ QE BLD UR NIT
Calcium	CALCIUM,SERUM	LRZ QO CLACIUM SER	LRZ QI CLACIUM SER	LRZ QE CLACIUM SER
CARDIAC ENZYMES	CARDIAC PROFILE	LRZ QO CARDIAC PROFILE	LRZ QI CARDIAC PROFILE	LRZ QE CARDIAC PROFILE
CBC	COMPLETE BLOOD COUNT	LRZ QO CBC	LRZ QI CBC	LRZ QE CBC
Coagulation profile	COAGULATION PROFILE	LRZ QO COAG PROFILE	LRZ QI COAG PROFILE	LRZ QE COAG PROFILE
Complete hemogram	COMPLETE HAEMOGRAM,PREPHERAL SMR & ESR	LRZ QO COPLT HEMOGRAM	LRZ QI COPLT HEMOGRAM	LRZ QE COPLT HEMOGRAM
CPK	CREATINE KINASE			
CPK - MB	CREATININE KINASE MB			
D Dimer	D-DIMER (QUANTITATIVE)	LRZ QO D-DIMER	LRZ QI D-DIMER	LRZ QE D-DIMER
DIFFERENTIAL COUNT	DIFFERENTIAL COUNT	LRZ QO DIFF COUNT	LRZ QI DIFF COUNT	LRZ QE DIFF COUNT
ERYTHROCYTE SEDIMENTATION RATE	ESR (WESTERGREN)	LRZ QO ESR	LRZ QI ESR	LRZ QE ESR

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dept	category	no of people					super user				
		cprs	radio	lab	pharma	surgery	cprs	radio	lab	pharma	surgery
accident	physician	10				10	1	0	0	0	1
Anesthesia	Physician	25				25	1.25	0	0	0	1.25
	Paramedic					27	0	0	0	0	1.35
Cardiac Sciences	Physician	19				19	1	0	0	0	1
	Paramedic					47	0	0	0	0	2.35
	Support					2	0	0	0	0	1
Critical Care	Physician	15				2	1	0	0	0	1
Facilities Management	Front office		403	403			0	20.15	20.15	0	0
Lab Services	Physician	11					1	0	0	0	0
	Paramedic			142			0	0	7.1	0	0
	Support			2			0	0	1	0	0
Medical Administration	Physician	5					1	0	0	0	0
	Front office		3	3			0	1	1	0	0
Medical Support	Physician	86					4.3	0	0	0	0
Mental Health	Physician	6					1	0	0	0	0
MS Office	Physician	3					1	0	0	0	0
Nephrology	Physician	1				1	1	0	0	0	1
Neuroscience	Physician	18				18	1	0	0	0	1
	nursing	1				1	1	0	0	0	1
	Paramedic	4				1	1	0	0	0	1
Nuclear medicine	Physician	2				2	1	0	0	0	1
Nursing	nursing	1900				2	95	0	0	0	1
	support	5					1	0	0	0	0
OBS & gynae	Physician	21				21	1.05	0	0	0	1.05
Oncology	Physician	8				4	1	0	0	0	1
Ophthalmology	Physician	1				1	1	0	0	0	1
	paramedic					2	0	0	0	0	1
Orthopaedics	Physician	6				6	1	0	0	0	1
	paramedic					2	0	0	0	0	1
OT	nursing	1				1	1	0	0	0	1

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				Numbers at each Location						
	Department	Role	Category	MHVI/DD	Saket MSSH	Ggn	Noida	PPG	Ppura	Okhla
	Accident and Surgery	Emergency Medical Officer		4						
		Junior Consultant-Emergency Services & Coordinator - Executive Trustee's Office		1						
		Senior Emergency Medical Officer		2						
	Nursing	Staff nurse	Nursing	186	212					
		Nurse educator	Nursing	1	0					
		Store officer	Nursing	1						
		Team lead	Nursing	1	1					
		Team leader	Nursing	1	2					
		Team leader-nursing	Nursing	28	33					
	OBS & gynae	Attending consultant	Physician	0	3					
		Director-obs & gynae & surgical gynae oncology	Physician	0	1					
		Junior resident	Physician	0	1					
		Technician O.T (Obs & Gynae)	Paramedics	0	1					
	Oncology	Director-medical oncology	Physician		1					
		Chief medical physicist	Paramedics		1					
		Chief radiotherapy technologist	Paramedics		1					
		Consultant medical physicist	Physician		1					
		Medical physicist	Paramedics		2					
		Radiotherapy technologist	Paramedics	1	3					
		Junior resident	Physician		1					
	Ortho	O.T technician	Paramedics		1					
		Senior technician	Paramedics		2					
		Senior technician -O.T	Paramedics		1					
		Team leader	Paramedics		1					
		Consultant	Paramedics		1					
		Senior consultant	Paramedics		1					

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HOSPITALS AUTOMATION SURVEY

This survey is being conducted to find out views regarding the hospitals getting automated.This questionnaire has got 13 questions, it will take 4-6 minutes to fill it.This questionnaire is only for those people who have visited both automated and non-automated hospital/s.

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* Required

1) Name * If you do not want to disclose your identity,please write'ANONYMOUS'

2) Age *

3) Educational Qualification *

4) E-mail I.D *

5) Contact Number (optional)

6) Occupation *

7) How often do you use computers? *

- Daily
- Frequently
- Occasionally
- Rarely

8) Have you been to both types of hospitals, i.e. a non I.T enabled hospital and an IT enabled one? * In this question, IT enabled hospitals are ones which maintain a digital record of your medical care in both OPD and Inpatient practice

- Yes
- No

Continue »

HOSPITALS AUTOMATION SURVEY

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* Required

Page 2

9) Did you find any difference in the time taken in the processes like registration, billing etc.? *

- Yes, it took me LESSER TIME in I.T enabled hospital
- Yes, it took me MORE TIME in I.T enabled hospital
- No. the time taken was same
- Could not/ did not notice

10) Did you find any difference in quality of healthcare being provided in both the hospitals? *

- Yes, I.T enabled hospitals provided better quality of healthcare
- Yes, NON-I.T enabled hospitals provided better quality of healthcare
- The Quality was same in both the hospitals

11) Do you think that automating a hospital makes the entire process (registration,billing,diagnosis and treatment) more transparent? *

- Yes
- No
- Don't know

12) Do you think doctors and nurses tend to spend lesser time with the patients, if they have to enter the information in the systems? *

- Yes

- No
- Don't know

13) If, given a choice, what would you choose? *

- I.T enabled hospital but only if it costs the same as non. I.T enabled hospital
- I.T enabled hospital even if there is added cost for digital permanent records/registration.
- I will choose a non-I.T enabled hospital

Thanks for your time

- Only the responses of those individuals will be recorded who have visited both types of hospitals.
-
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