Dissertation Title

"Comparative analysis of feature's of Physician's Module in existing Hospital Information System with VistA CPRS module".

A dissertation submitted in partial fulfillment of the requirements for the award of

Post-Graduate Diploma in Health and Hospital Management

By

Tanika Kaistha

Roll No. PG/09/053

International Institute of Health Management Research

New Delhi -110075

November,2010

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under the guidance of

Dr.Vivek Sahi
Senior Consultant
DELL Services

Prof. Indrajit Bhattacharya
Assistant Professor
IIHMR, New Delhi

International Institute of Health Management Research

New Delhi -110075

November,2010

Certificate of Internship Completion

Date: 03-12-2010

TO WHOM IT MAY CONCERN

This is to certify that Dr.Tanika Kaistha has successfully completed her 3 months internship in our organization from August 9, 2010 to November 9, 2010. During this intern has worked on Clinical Templates and CPRS configuration under the guidance of me and CPRS Configuration team at DELL Services.

any positive/negative comment :

We wish her good luck for her future assignments

(Signature)

Dr. Vivek Sahi
Clinical Transformation Consultant

Certificate of Approval

The following dissertation titled **"Comparative analysis of feature's of Physician's Module in existing Hospital Information System with VistA CPRS module"** 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
1.	Dr. Vivek Sahi	_____
	_____	_____
	_____	_____

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Tanika Kaistha**, 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 **"Comparative analysis of feature's of Physician's Module in existing Hospital Information System with VistA CPRS module"** 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	Dr.Vivek Sahi
Professor	Clinical Transformation Consultant
IIHMR	DELL Services
New Delhi	Sec. 125, Noida, UP
Date	03-12-2010

Acknowledgement

I hereby take this opportunity to thank, Dr.Vivek Sahi, Senior Consultant, DELL Services for the valuable guidance and advice. He inspired me greatly to work in this project. His willingness to motivate me contributed tremendously to my project.

My special thanks to Dr.Rajesh Gupta, Principal Consultant and Manager, VistA Configuration, for his guidance, support, interest, involvement and encouragement. He has left no stone unturned in updating me regarding the subject.

I wish to express my deep sense of gratitude to Dr. Saurabh Bhatia, Senior Principal Consultant and Manager, Training, for giving me the opportunity to do my Internship and Dissertation at DELL Services. He was very kind enough to spare his valuable time and provided several important suggestions at every stage of my study.

Besides, I would also like to thank the entire Healthcare IT team for their encouragement and cooperation in carrying out the project work.

My sincere acknowledgement goes to Professor Indrajit Bhattacharya and Professor Aanandhi Ramachandran for their kind assistance and support throughout my dissertation.

Finally, an honorable mention goes to my family and friends for their understanding and support on me in completing this project.

Thank You

Tanika Kaistha

PGDHHM,

IIHMR, New Delhi

Abstract

Comparative analysis of a Home grown HIS physician module with the upcoming CPRS module in VistA in a Hospital

By
Tanika Kaistha

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~~Introduction :~~

This project is based on the comparative analysis of a Home grown HIS physician module with the CPRS module in VistA in a Hospital ABC which is a chain of 8 hospitals located in the NCR region.The Hospital is a leading and well respected corporate healthcare provider in India. It provides high quality healthcare services at primary, secondary and tertiary levels. HIS or Hospital Information System is an application developed by the Hospital to automate the various processes being followed in their hospitals. HIS has transformed the way hospital functions. Hospital has continuously invested in Information Systems, from the Hospital Information System (HIS) to Accounting and Financial System, Picture Archiving and Communication System (PACS), Quality Information System, Telemedicine and Business Intelligence. A crucial piece of information that is still missing within the broad picture of healthcare automation relates to the Electronic Patient Health Record, which would contribute, in a large measure to the attainment of medical excellence. So it is essential to know what the organizations current Physician module contains and how the CPRS module of VistA will help in achieving the organization's goals and objectives.

This project on comparative analysis of Physician module with VistA CPRS will through light on how the physician module was developed as per the needs of the doctors working in the hospital without thinking of the long term benefits that the organization can have from an updated Physician module. As the Hospital strives for medical excellence and 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 which the upcoming module does support and caters to the organizations long term goals effectively. Some of the benefits are mentioned below

- Time - Real time flow of information
- Place - Remote dissemination of information

- Standardization - processes & workflows
- Coordination - care providers
- Decision support – clinical knowledgebase, Clinical pathways & protocols
- Retrospective analysis – trends, audits, outcomes

The major findings are:

1. In order to deliver quality medical care requires the integration of clinical diagnosis, procedures performed, and the expenditure and cost which is not present in the existing HIS physician module
2. The CPRS module of VistA is clinically the richest module and helps the doctors to capture the patient details completely and maintain the health record of the patient. In addition, CPRS supports clinical decision-making and enables you to review and analyze patient data.

The Methodology adopted for the project was:

- Primary data collection through observation, questionnaires and interviews.
- Secondary data collection

The primary data collection was done through observation, questionnaires and interviews. Secondary Data Sources include the review of the features of HIS Physician module and VistA software, VistA Manual and VistA CPRS Software Document.

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Table of Contents

List of Figures

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~~Thank You~~

~~Tanika Kaistha~~

~~PGDHHM,~~

~~IIHMR, New Delhi~~

List of Appendix

Abbreviations

- **CPRS** COMPUTERIZED PATIENT RECORD SYSTEM
- **EHR** ELECTRONIC HEALTH RECORDS
- **EMR** ELECTRONIC MEDICAL RECORDS
- **HL-7** HEALTH LEVEL-7
- **HIS** HOSPITAL INFORMATION SYSTEM
- **PACS** PICTURE ARCHIVAL AND COMMUNICATION SYSTEM
- **CPOE** COMPUTERISED PATIENT ORDER ENTRY
- **BCMA** BAR CODE MEDICATION ADMINISTRATION
- **MUMPS** MASSACHUSETTS GENERAL HOSPITAL UTILITY MULTI-PROGRAMMING SYSTEM
- **DBMS** DATA BASE MANAGEMENT SYSTEM
- **VistA** VETERANS HEALTH INFORMATION SYSTEMS AND TECHNOLOGY ARCHITECTURE
- **API** APPLICATION PROGRAMMING INTERFACE
- **TAT** TURN AROUND TIME
- **DHHS** DEPARTMENT OF HEALTH AND HUMAN SERVICES
- **CCHITSM** CERTIFICATION COMMISSION FOR HEALTHCARE INFORMATION TECHNOLOGY
- **ADOPTS** ACCESS, DEFINE, OPTIMIZE, PREPARE, TRANSFORM AND SUSTAIN
- **GUI** GRAPHIC USER INTERFACE
- **PIMS** PATIENT INFORMATION MANAGEMENT SYSTEM

Part I: Internship Report

1.1 INTRODUCTION

1.1.1 DELL-services Profile

Dell Services (formerly Perot Systems) 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[13].

1.1.2 History:

H. Ross Perot and eight associates founded Perot Systems in June 1988 after having sold 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.

1.1.3 Acquisition:

The acquisition resulted in a compelling combination of two iconic information-technology brands. 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. Company ratings are based on eight criteria, including everything from investment value and quality of products/services to innovation and quality of management[9].

The expanded Dell is 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 DELL Services' capabilities, including in the most dynamic customer segments, around the world.

1.1.4 Location:

Express Way, Noida

Perot Systems TSI (India) Ltd.

Corporate Office Plot No. 3, Sector-125, Noida- 201301, U.P

1.1.5 Vision:

Dell services will be the most trusted industry leader in global information technology and business process services.

1.1.6 Mission:

- Dell services will be a vital contributor to the overall success of dell.
- Through our expertise execution and professional integrity we will develop and maintain lasting relationships with our customer.
- We will develop and deploy advanced and differentiated
- Support and next generation services, deepen our industry domain expertise, and expand our geographic depth and presence.
- We will always deliver real and measurable results for our customers.
- We will invest in training and development for our team, value and respect one another, focus maniacally on serving our customers and have fun doing it.
- The CIO organization will be recognized for technical excellence and industry, leading efficiency, planning and execution

1.1.7 Industries:

- Consumer Products and Services
- Federal Government
- Financial Services
- Logistics & Distribution
- Healthcare
- Insurance
- Manufacturing
- Telecommunications
- Travel and Transportation

1.1.8 Services:

Dell Services is a worldwide provider of information technology

- Application services like Application Modernization.
- Business process services like Finance and Accounting Solutions.
- Consulting services like Finance and Accounting Solutions.
- Infrastructure services like End-User Computing.
- Virtual services like Cloud Integration Services.

1.2 Background of client hospital:

Founded in 1985, ABC India Ltd. is a Public Limited company listed on the NSE and BSE of India with over 30,000 shareholders. ABC India Limited is a multi-business corporate entity driven by the spirit of enterprise with a focus on people and service oriented businesses. Prominent shareholders of the company are Mr Analjit Singh and a leading private equity firm, Warburg Pincus. The balance shareholding is held by the public and Institutional Investors.

The company´s vision is "to be one of India´s most admired corporates for Service Excellence." Towards this end, it has established businesses that are today recognized as being at the fore front of service excellence, in each of the industry sectors where it operates. Performance, Trust and Service Excellence are enshrined in ABC India Group´s Vision, Mission and Values.

1.2.1 Client Hospitals:

ABC Super Specialty Hospital(DD Foundation), Saket
ABC Super Specialty Hospital, Saket
ABC Super Specialty Hospital, Patparganj
ABC Hospital - Pitampura
ABC Hospital - Noida
ABC Medcentre - Panchsheel Park
ABC Specialty Centre - Panchsheel Park
ABC Hospital - Gurgaon

In 2009 the client hospital signed a contract with the DELL Services for **Electronic Health Record (EHR)-VistA implementation** and support and services for 10 years.

1.3 Healthcare IT vertical of Dell Services

In Healthcare IT, DELL Services provides various solutions to the healthcare provider's, one of the solution is EHR (Electronic Health Record).

1.3.1 Electronic Health Record (EHR)

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[7].

1.3.2 Advantages of an Electronic Health Record:

- Easy access to information
- Comprehensive and standardized documentation
- Improved quality of patient care
- Increased efficiency of healthcare professionals
- Improved process communication
- Reduced medication errors
- Meet various accreditation requirements
- Reduced TPA denials
- Better control of Management
- Reduced pilferages

1.3.3 Number of Departments allotted for EHR implementation:

EHR Implementation:

- Clinical Transformation
- EHR
- Training
- Infrastructure and Application
- Integrating HIS System

1.3.4 For implementing EHR in Client Hospital, DELL Services is using VistA software:

1.3.4.1 Veterans Health Information Systems and Technology Architecture (VistA):

VistA- introduction

- Complete EMR Solution - **V**eterans Health **I**nformation **S**ystems **T**echnology & **A**rchitecture
- Electronic Medical Record
- Over 130 clinical modules to select from (VistA Monograph)
- Thousands of man years of code development along with an evolving architecture
- Thousands of application programs (business logic) wrote in Mumps.
- Infrastructure provided by many platforms and architectures

WorldVistA is an open source implementation of the Veteran Administration's Electronic Health Record system intended for use in health care facilities outside the VA[1].

Background

The US Veterans Administration developed the most widely distributed Electronic Health Record used in the US, the Veterans Health Information Systems and Technology Architecture (VistA). In an effort to make the system widely available to institutions outside the Veterans Administration health system, the software code was placed in the Public Domain under the Freedom of Information Act[12].

The foundation for the WorldVistA EHR was formed to extend and collaboratively improve the VistA electronic health record and health information system for use outside of its original setting. It was originally developed as part of the VistA-Office project, a collaborative effort funded by the United States Centers for Medicare and Medicaid Services (CMS), an agency of the US Department of Health and Human Services (DHHS)[2].

WorldVistA EHR VOE/ 1.0 is based on and compatible with the U.S. Department of Veterans Affairs (VA) world renowned EHR, Veterans Health Information Systems and

Technology Architecture (VistA). A fully open-source (GPL v2 licensed) project, WorldVistA has also developed software modules (such as pediatrics, obstetrics, and other functions) not used in the veterans' healthcare setting[10].

In 2006, WorldVistA EHR VOE/ 1.0 was the only open source EHR that met Certification Commission for Healthcare Information Technology (CCHITSM) ambulatory electronic health record (EHR) criteria, and in January 2008, it was released with full CCHITSM EHR.

As a free product developed in co-operation with the US government, WorldVistA is not marketed in a similar fashion to commercial EHRs.

Core VistA functions

- Patient registration
- Clinical reminders for chronic disease management
- Clinical order entry
- Progress note templates
- Results reporting

Customizable functions

The structure of WorldVistA is modular, and a wide variety of customization is possible. Because it is fully open source, this can be done without restriction (although CCHIT certification is granted only to the officially maintained package).

- Ability to interface to existing practice management / billing systems, lab services and other applications
- Scanning and inclusion of scanned documents into the medical record
- Prescription finishing and faxing
- Clinical quality measure reporting capabilities
- Support for disease management, using clinical reminders
- Templates for all the specialties

1.3.4.2 BUSINESS OBJECTIVES OF VistA:

1. Create an integrated platform to drive the capture of complete patient diagnosis and to help improve quality of Healthcare by reducing wrong medication
2. Implement VistA EHR for the clinical requirements of client hospital.
3. Integrate VistA with the Client hospital HIS through HL7 based integration
4. Use Dell Services Clinical Transformation methodology ADOPTS (Access, Define, Optimize, Prepare, Transform and Sustain)to drive user adoption of VistA and help client hospital derive the expected return on investment on VistA.

1.3.4.3 Features:

The VistA system is public domain software, available through the Freedom of Information Act directly from the VA website, or through a growing network of distributors. The VistA software alliance is a non-profit trade organization that both promote the widespread adoption of versions of VistA for a variety of provider environments. VistA is a collection of about 100 integrated software modules[14].

1.3.4.4 VistA functionality for the EHR solution for end users can be divided into the following modules.

- CPRS – Computerized Patient Record System
- Radiology – Roll and Scroll
- VistA Lab – Roll and Scroll
- VistA Imaging – This is a GUI and linked to CPRS
- Pharmacy – Roll and Scroll
- Surgery
- Dietetics
- PIMS- Patient Information Management System

1.3.4.5 Computerized Patient Record System (CPRS) Module:

The most significant is a graphical user interface for clinicians known as the Computerized Patient Record System (CPRS), which was released in 1997. In addition, VistA includes computerized order entry, bar code medication administration, electronic prescribing and clinical guidelines. CPRS provides a client–server interface that allows health care providers to review and update a patient's electronic medical record. This includes the ability to place orders, including those for medications, special procedures, X-rays, nursing interventions, diets, and laboratory tests. CPRS provides flexibility in a wide variety of settings so that a consistent, event-driven, Windows-style interface is presented to a broad spectrum of health care workers. CPRS provides electronic data entry, editing, and electronic signatures for provider-patient encounters as well as provider orders. Its computer-based provider order entry (CPOE) capability is an important enabler in the migration from paper-based charting to electronic medical records (EMRs).

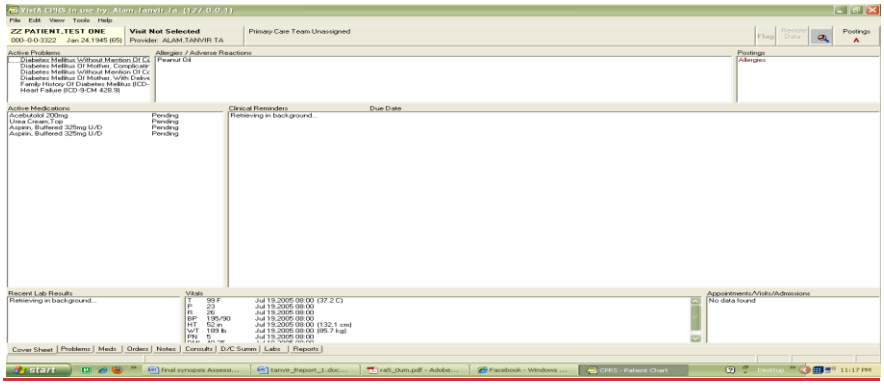

Figure 1.Coversheet of VistA CPRS

1.3.4.6 Laboratory Module:

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

1.3.4.7 Radiology module:

The Veterans Health Information Systems and Technology Architecture (VistA) 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.

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1.3.4.8 PIMS module:

The heart of the EMR module is the **Patient information management system** (PIMS). Patient Information Management System (PIMS) is a suite of software which is one of the modules in vistA. It allows professionals in the medical field to organize, schedule, and analyze patient information.

IT enhances the patient flow from admission to discharge by developing a shared electronic record that contains all of the required information on a patient's progress

It enables clinicians to view the demographics, making tracking a patients a far easier and quicker process.

1.4 Managerial tasks assigned:

For this project I was allotted to work with CPRS configuration team and was assigned a managerial task by my mentor Dr.Vivek Sahi. The task was to understand the requirements of clinical template from the clinical transformation team and accordingly design the same on VistA CPRS. The VistA CPRS module is going to be implemented in the client hospital as a part of EHR implementation

He provided me the documents needed for the study, told me why this study is needed and how the results of this study can help in the project.

1.5 Reflective learning:

In my dissertation along with my project I worked in different teams like:

- Created and designed clinical templates for the various specialties of Hospital.
- Configured clinical reminders, health summary, health factors, consults, procedures, notifications, reminder dialogs in roll and scroll.
- Worked in close coordination with clinical transformation team to get the requirements from the client and then design the same in VistA CPRS.
- Also studied the as is workflows of different departments of hospital and learned how to make new workflows which will be used in the implementation of the VistA-EHR.

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~~Part I : Internship Report~~

PART II

Dissertation on- "Comparative analysis of a Home grown HIS physician module with the upcoming CPRS module in VistA in a Hospital".

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A. Dissertation Overview

2.1Nature of the problem

This study focuses on the in depth study of the Client hospital existing HIS Physician module, and highlighting the amount of patient data being captured by the system, then comparing it with the VistA CPRS electronic health record which is widely accepted in US VA Hospitals and on the basis of it suggesting features which an ideal Physician module should have. This study also highlights as to why the client hospital has decided to go in for VistA CPRS EHR instead of updating its own existing Physician module of HIS.

2.2 General Objective :

Comparative analysis of a home grown HIS physician module with the CPRS module in VistA in a Hospital ABC

2.3 Specific Objectives :

The specific objectives are:

1. To study the existing Physician Module of HIS
2. To study the VistA CPRS Module in detail
3. To recommend in the end what an Ideal Physician module should have.

~~1.~~ **2.4 Scope of the project:**

~~2.~~ The study mainly analyzes the HIS Physician module of the client with respect to VistA CPRS Module. The results of this study will through light on the points which are to be kept in mind when hospital management wants to go in for hospital automation, and are looking out for the best physician module for their Hospital setup. This study also analyzes the client hospital's requirements with respect to VistA CPRS. Overall this study helps in understanding the basic requirements of any physician department; the features supported by VistA CPRS module and hence can help IT companies to build software based on VistA CPRS module

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2.5 Need and benefits

Hospital information systems are turning to be a new need for medical organizations to survive in throat cut business struggles. Also, changing face of technology has enabled medical organizations to prove themselves committed for better healthcare solutions with improved services[2]. The physician module was developed as per the needs of the doctors working in the hospital without thinking of the long term benefits that the organization can have from an updated Physician module. As the Hospital strives for medical excellence and 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 which the upcoming module does support and caters to the organizations long term goals effectively[3]. Some of the benefits are mentioned below

- Time – Real time flow of information
- Place – Remote dissemination of information
- Standardization – processes & workflows
- Coordination – care providers
- Decision support – clinical knowledgebase, Clinical pathways & protocols
- Retrospective analysis – trends, audits, outcomes

2.6 Assumptions

1. It is assumed that the people who participated in the interviews and group discussions are well versed with the existing HIS Physician Module.
2. The department has well established workflow which is adhered properly.
3. The hospital adheres to the accrediting standards in order to ensure quality services to the patients.

~~3.~~ 2.7 Data Sources

- HIS Physician manual (Client Hospital)
- VistA Manual (http://www.vista.gov)
- HIS Workflow (Client Hospital)

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- CPRS Workflow (VistA Radiology)
- VistA CPRS Manual
- Requirement Document of VistA-EHR CPRS Module v1.0 (Dell)

2.8 Work Plan

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ACTIVITY	TIME TAKEN
Defining the Problem	9th AUG – 29th AUG 2010
Literature Survey	30th AUG- 12th SEP 2010
Methodology Adopted	13th SEP-19th SEP 2010
Data Collection	20th SEP-10th OCT 2010
Compilation and Analysis	11TH OCT-25TH OCT 2010
Documentation	26TH OCT-9TH NOV 2010

Table 1.Work Plan Breakdown

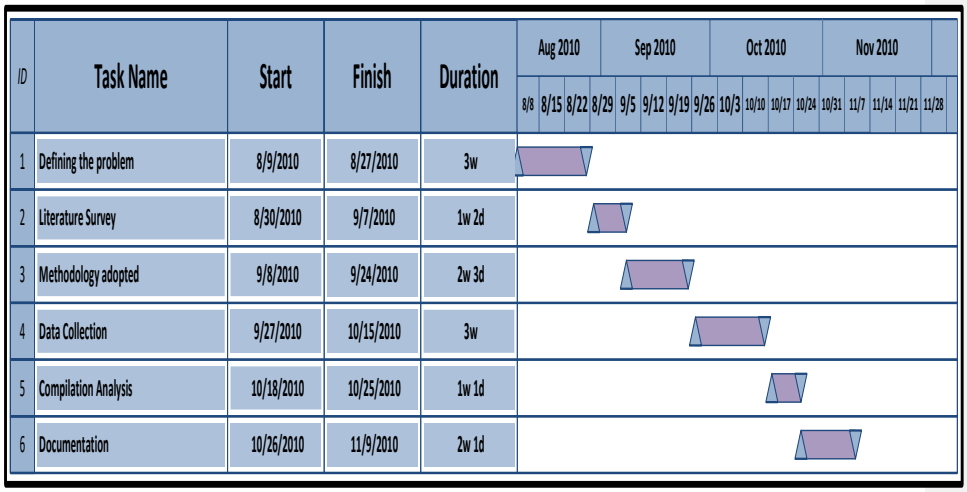

Table 2.Gantt chart showing project work breakdown Plan

ID	Task Name	Start	Finish	Duration
1	**Defining the problem**	**8/9/2010**	**8/27/2010**	**3w**
2	Identifying the nature of Problem	8/9/2010	8/13/2010	1w
3	Defining Objective and Scope of Project	8/16/2010	8/20/2010	1w
4	Defining the need,benefits and assumptions,Limitations	8/23/2010	8/27/2010	1w
5	**Literature Survey**	**8/30/2010**	**9/7/2010**	**1w 2d**
6	Referring to internet search,whitepapres,journals	8/30/2010	9/3/2010	1w
7	Referring to books	9/6/2010	9/7/2010	2d
8	**Methodology adopted**	**9/8/2010**	**9/24/2010**	**2w 3d**
9	Observations,Interviews	9/8/2010	9/14/2010	1w
10	Observations, Group Discussions	9/15/2010	9/24/2010	1w 3d
11	**Data Collection**	**9/27/2010**	**10/15/2010**	**3w**
12	Primary Data Collection	9/27/2010	10/8/2010	2w
13	Secondary Data Collection	10/11/2010	10/15/2010	1w
14	**Compilation Analysis**	**10/18/2010**	**10/25/2010**	**1w 1d**
15	**Documentation**	**10/26/2010**	**11/9/2010**	**2w 1d**

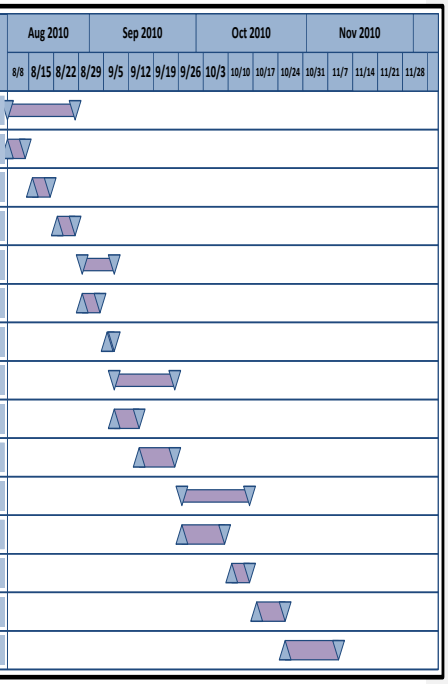

Table 3.Gantt chart showing in detail project work breakdown plan

~~4.~~ 2.9 Limitations

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~~5.~~ This study mainly takes into consideration only one hospital information system and due to confidentiality issues only part of the methodology could be adopted as questionnaires were not allowed to be used for empirical study purposes.

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Also the GUI screens of the existing HIS system of client hospital cannot be displayed due to confidential reasons.

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B. Project Overview

3.0. Introduction

This project is based on the comparative analysis of a Home grown HIS physician module with the CPRS module in VistA in a Hospital ABC which is a chain of 8 hospitals located in the NCR region.The Hospital is a leading and well respected corporate healthcare provider in India. It provides high quality healthcare services at primary, secondary and tertiary levels. HIS or Hospital Information System is an application developed by the Hospital to automate the various processes being followed in their hospitals. HIS has transformed the way hospital functions. Hospital has continuously invested in Information Systems, from the Hospital Information System (HIS) to Accounting and Financial System, Picture Archiving and Communication System (PACS), Quality Information System, Telemedicine and Business Intelligence [10]. A crucial piece of information that is still missing within the broad picture of healthcare automation relates to the Electronic Patient Health Record, which would contribute, in a large measure to the attainment of medical excellence. So it is essential to know what the organizations current Physician module contains and how the CPRS module of VistA will help in achieving the organization's goals and objectives.

Hospital automation is not simply a matter of computerizing existing hospital procedures; rather, it focuses on sharing of patient information (inter-departmental and inter-hospital) between hospitals and the community, medical insurers, health administration authorities, etc [2]. The aim is to provide patients with the best care and service provide doctors and nurses with the best support and provide management with accurate and timely information for analysis and decision making [5]. It also throughs light on how the physician module was developed as per the needs of the doctors working in the hospital without thinking of the long term benefits that the organization can have from an updated Physician module. According to American Professor Morris F. Collen's definition, an HIS is a comprehensive, integrated information system designed to provide hospital departments with the ability to collect, store, process, retrieve and communicate patient and administrative information. The system needs to meet all the functional requirements of the authorized users, with the use of computers and communication facilities [3].

An EHR system includes

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1. Longitudinal collection of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or a health care provider to an individual
2. Immediate electronic access to person and population level information n by authorized and only authorized users
3. Provision of knowledge and decision support that enhances the quality,safety and efficiency of patient care
4. Support for efficient process for health care delivery. [1]

3.1. LITERATURE SURVEY:

3.1.1. Using VistA electronic medical record data extracts to calculate the waiting time for total knee arthroplasty.

(Hussain T, Bell B, Brandt C, Nuzzo J, Erdos JJ.Yale University School of Medicine, Yale Center for Medical Informatics, New Haven, Connecticut 06511, USA.)

This is a retrospective database study of veterans who had total knee arthroplasty (TKA) at Veterans Affairs Connecticut Healthcare System. The objective of this study is to determine if VistA medical records data can be used to create a methodology for accurate assessment of waiting times for TKAs performed at Veterans Affairs facilities. The average waiting period from date of "initial consult" to date TKA was performed was greater than two years. The average waiting period from "most recent consult" to TKA was less than a year. This new approach and methodology has great impact as it provides an electronic method for calculating the TKA wait time which is broadly generalizable for similar analysis at the VISN (Veteran Integrated Services Network) or regional level.

3.1.2.Filmless radiology at the Baltimore VA Medical Center: a 9 year retrospective.

(Hussain T, Bell B, Brandt C, Nuzzo J, Erdos JJ.Yale University School of Medicine, Yale Center for Medical Informatics, New Haven, Connecticut 06511, USA.)

This is a retrospective database study of veterans who had total knee arthroplasty (TKA) at Veterans Affairs Connecticut Healthcare System. The objective of this study is to determine if VistA medical records data can be used to create a methodology for accurate assessment of waiting times for TKAs performed at Veterans Affairs facilities. The average waiting period

from date of "initial consult" to date TKA was performed was greater than two years. The average waiting period from "most recent consult" to TKA was less than a year. This new approach and methodology has great impact as it provides an electronic method for calculating the TKA wait time which is broadly generalizable for similar analysis at the VISN (Veteran Integrated Services Network) or regional level.

3.1.3.Costs and benefits of health information technology.

(Shekelle PG, Morton SC, Keeler EB.)

Objectives: An evidence report was prepared to assess the evidence base regarding benefits and costs of health information technology (HIT) systems, that is, the value of discrete HIT functions and systems in various healthcare settings, particularly those providing pediatric care.

Data sources: PubMed, the Cochrane Controlled Clinical Trials Register, and the Cochrane Database of Reviews of Effectiveness (DARE) were electronically searched for articles published since 1995. Several reports prepared by private industry were also reviewed.

Review methods: Of 855 studies screened, 256 were included in the final analyses. These included systematic reviews, meta-analyses, studies that tested a hypothesis, and predictive analyses. Each article was reviewed independently by two reviewers; disagreement was resolved by consensus.

Results: Of the 256 studies, 156 concerned decision support, 84 assessed the electronic medical record, and 30 were about computerized physician order entry (categories are not mutually exclusive). One hundred twenty four of the studies assessed the effect of the HIT system in the outpatient or ambulatory setting; 82 assessed its use in the hospital or inpatient setting. Ninety-seven studies used a randomized design. There were 11 other controlled clinical trials, 33 studies using a pre-post design, and 20 studies using a time series. Another 17 were case studies with a concurrent control. Of the 211 hypothesis-testing studies, 82 contained at least some cost data. We identified no study or collection of studies, outside of those from a handful of HIT leaders, that would allow a reader to make a determination about the generalizable knowledge of the study's reported benefit. Beside these studies from HIT leaders, no other research assessed HIT systems that had comprehensive functionality and included data on costs, relevant information on organizational context and process change,

and data on implementation. A small body of literature supports a role for HIT in improving the quality of pediatric care. Insufficient data were available on the costs or cost-effectiveness of implementing such systems. The ability of Electronic Health Records (EHRs) to improve the quality of care in ambulatory care settings was demonstrated in a small series of studies conducted at four sites (three U.S. medical centers and one in the Netherlands). The studies demonstrated improvements in provider performance when clinical information management and decision support tools were made available within an EHR system, particularly when the EHRs had the capacity to store data with high fidelity, to make those data readily accessible, and to help translate them into context-specific information that can empower providers in their work. Despite the heterogeneity in the analytic methods used, all cost-benefit analyses predicted substantial savings from EHR (and health care information exchange and interoperability) implementation: The quantifiable benefits are projected to outweigh the investment costs. However, the predicted time needed to break even varied from three to as many as 13 years.

Conclusions: HIT has the potential to enable a dramatic transformation in the delivery of health care, making it safer, more effective, and more efficient. Some organizations have already realized major gains through the implementation of multifunctional, interoperable HIT systems built around an EHR. However, widespread implementation of HIT has been limited by a lack of generalizable knowledge about what types of HIT and implementation methods will improve care and manage costs for specific health organizations. The reporting of HIT development and implementation requires fuller descriptions of both the intervention and the organizational/economic environment in which it is implemented.

3.1.4. A Filmless Radiology Department in a Full Digital Regional Hospital: Quantitative Evaluation of the Increased Quality and Efficiency

(Andrea Nitrosi, Giovanni Borasi,Franco Nicoli, Gino Modigliani, Andrea Botti, Marco Bertolini,and Pietro Notari ,Servizio di Fisica Sanitaria, Arcispedale Santa Maria Nuova, V.le Risorgimento 80, 42100 Reggio Emilia (RE), Italy ,2Arcispedale Santa Maria Nuova—Dipartimento di Diagnostica per Immagini—Servizio di Radiologia, Reggio Emilia (RE), Italy)

Background

Reggio Emilia' Arcispedale Santa Maria Nuova is a 900-bed public regional acute care hospital. Major investments in medical equipment and health care information systems have been made in recent years. The hospital invests more than 2% of its global budget in Information Technology (IT, Picture Archiving and Communications Systems (PACS) excluded) annually. Approximately 180,000 imaging examinations are performed every year by the Radiology Department, with a large outpatient population of 40%. Emergency department represents 31% of the workload, while inpatient and day patients account for the remaining 29%.

Results:Film Savings

Film savings during the period immediately following system installation, April to October, 2003, were 15%, and grew to 90% as soon as the workflow became filmless 28 weeks after go live. Only mammography remained film-based. All of the studies' images were available on intranet PACS web distribution. Outpatients' key images are automatically burned on CD. Patients who require iconography film prints pay an additional fee. Film savings correspond to $0.84 million per year versus pre-PACS.

Outpatient Productivity

Data analysis measured a 7% increase in the number of radiology department imaging procedures year over year during the same 6-month period (October 15 to April 15) with no increase in the number of technologists or radiologists,13 thanks to the combined PACS and CR/DR implementation.

3.1.5.Open source challenges for hospital information system (HIS) in developing countries: a pilot project in Mali

(Cheick-Oumar Bagayoko, Jean-Charles Dufour, Saad Chaacho, Omar Bouhaddou, and Marius Fieschi,DER Santé Publique, Faculté de Médecine, Pharmacie et d'Odonto-Stomatologie, Bamako, Mali,Laboratoire d'Enseignement et de Recherche sur le Traitement de l'Information Médicale, Faculté de Médecine, Université de la Méditerranée 27, boulevard Jean Moulin 13385 Marseille Cedex 5)

Background

We are currently witnessing a significant increase in use of Open Source tools in the field of health. Our study aims to research the potential of these software packages for developing countries. Our experiment was conducted at the Centre Hospitalier Mere Enfant in Mali.

Methods

After reviewing several Open Source tools in the field of hospital information systems, Mediboard software was chosen for our study. To ensure the completeness of Mediboard in relation to the functionality required for a hospital information system, its features were compared to those of a well-defined comprehensive record management tool set up at the University Hospital "La Timone" of Marseilles in France. It was then installed on two Linux servers: a first server for testing and validation of different modules, and a second one for the deployed full implementation. After several months of use, we have evaluated the usability aspects of the system including feedback from end-users through a questionnaire.

Results

Initial results showed the potential of Open Source in the field of health IT for developing countries like Mali.

Five main modules have been fully implemented: patient administrative and medical records management of hospital activities, tracking of practitioners' activities, infrastructure management and the billing system. This last component of the system has been fully developed by the local Mali team.

The evaluation showed that the system is broadly accepted by all the users who participated in the study. 77% of the participants found the system useful; 85% found it easy; 100% of them believe the system increases the reliability of data. The same proportion encourages the continuation of the experiment and its expansion throughout the hospital.

Conclusions

In light of the results, we can conclude that the objective of our study was reached. However, it is important to take into account the recommendations and the challenges discussed here to avoid several potential pitfalls specific to the context of Africa.

Our future work will target the full integration of the billing module in Mediboard and an expanded implementation throughout the hospital.

3.1.6.HIS-based electronic documentation can significantly reduce the time from biopsy to final report for prostate tumours and supports quality management as well as clinical research

(Bernhard Breil, Axel Semjonow, and Martin Dugas,Department of Medical Informatics and Biomathematics, University of Münster, Domagkstraße 9, 48149 Münster, Germany)

Background

Timely and accurate information is important to guide the medical treatment process. We developed, implemented and assessed an order-entry system to support documentation of prostate histologies involving urologists, pathologists and physicians in private practice.

Methods

We designed electronic forms for histological prostate biopsy reports in our hospital information system (HIS). These forms are created by urologists and sent electronically to pathologists. Pathological findings are entered into the system and sent back to the urologists. We assessed time from biopsy to final report (TBF) and compared pre-implementation phase (paper-based forms) and post-implementation phase. In addition we analysed completeness of the electronic data.

Results

We compared 87 paper-based with 86 electronic cases. Using electronic forms within the HIS decreases time span from biopsy to final report by more than one day per patient ($p < 0.0001$). Beyond the optimized workflow we observed a good acceptance because physicians were already familiar with the HIS. The possibility to use these routine data for quality management and research purposes is an additional important advantage of the electronic system.

Conclusion

Electronic documentation can significantly reduce the time from biopsy to final report of prostate biopsy results and generates a reliable basis for quality management and research purposes.

3.1.7.Implementing an integrated computerized patient record system: Towards an evidence-based information system implementation practice in healthcare.

(Bahlol Rahimi, MSc,Anna Moberg, PhD, Toomas Timpka, MD, PhD,and Vivian Vimarlund, PhD,Department of Computer and Information Sciences, Linköping University, Linköping, Sweden;Östergötland County Council, Linköping, Sweden)

A large number of health information system (HIS) implementations fail due to insufficient organizational harmonization. The aim of this study is to examine whether these problems remain when implementing technically integrated and more advanced generations of HIS. In a case study, data from observations, interviews, and organizational documents were analyzed using qualitative methods. We found that critical issues in the case study implementation process were the techniques employed to teach the staff to use the integrated system, involvement of the users in the implementation process, and the efficiency of the human computer interface. Comparisons with a literature review showed both recurrence of previously reported implementation problems and new issues specific to the integrated system context. The results indicate that the development of evidence-based implementation processes should be considered.

4.0. METHODS OF DATA COLLECTION:

4.1. Methodology adopted:

The study involves the analysis of the primary as well as secondary data. Study also involves examining the current HIS physician module and the existing scenario of the OPD and IPD department of the client hospital. For this study all the features of the VistA CPRS and HIS Physician module are studied carefully and mapped with the requirements of the client and recommending an ideal physician module at the end.

4.2. Type of data:

Primary and Secondary data collection

4.3. Data collection tools:

- Review of the requirement document for CPRS department given by the DELL.
- Observation of features in HIS.
- Review of VistA CPRS Manual.
- Observation of the features VistA CPRS module.
- Interaction with the physician's of the client hospital.
- Interviews and Group discussion with the Implementation team of DELL.

4.4. Primary data collection:

- Discussions with the physician's of the hospital who are the users of the existing Physician module.
- Discussion with the administration and top management of the client hospital.
- Observation and review of the features of HIS (Hospital information System) Physician module and VistA CPRS Module.
- Direct Observation of the work processes using exiting HIS

4.5. Secondary data collection:

- Review of HIS Physician Manual.
- Review of current workflow of OPD and IPD department.

- VistA CPRS user Manual

4.6 Study design:

- Studying the features of the HIS
- Analyzing bottlenecks of the HIS
- Studying the features of the VistA CPRS
- Review of the requirement document for CPRS module
- Documentation of the results
- Recommendations an Ideal physician module

5 ~~Part II :Dissertation Report~~

Hospital ABC , established in 1999, is a leading and well respected corporate healthcare provider in India. Hospital ABC provides high quality healthcare services at primary, secondary and tertiary levels. Hospital ABC is a chain of 8 hospitals located in the NCR region.

Hospital group utilizes a Hospital Information System for the enterprise wide transaction handling and currently contains all the modules of Admission, Billing, Lab, Radiology, Pharmacy, Materials Management, Physician's, In Patient's, Operation theatre, MIS reports, Out patients, Emergency, Department of transfusion medicine.

A centralized database with an application running on server-client architecture promotes the aggregation of data from multiple hospitals and gives a unified view. Patient encounters are recorded on the information system with a trail of the services utilized, their consequent material consumption and billing. Flat reports are generated for a multitude of users both for operational tracking as well as for analysis, optimization and strategizing further growth plans for the hospitals.

However, competitive advantage to deliver quality medical care requires the integration of clinical diagnosis, procedures performed, and the expenditure and cost. The proposition is to be able to provide the highest quality care at the lowest possible cost to customers and patients. To allow customers and insurance companies to choose the highest quality clinical provider, the outcomes need to be measurable, reportable and reproducible. Hospital ABC would like to implement VistA (Open source EHR developed by Department of Veterans Affairs) that can be integrated with the existing Hospital HIS to provide advanced clinical functionality which is limited in the current HIS.

Now let us first of all understand the existing Physician Module of Hospital ABC in detail.

“Physician” module is to enter the clinical information of the patients. This module is primarily used by Doctors and their assistant to enter patient clinical information and to print e-prescription to the patient. Any Out Patient (OP) who has paid the bill will be displayed in the physician module. Patient who has not paid the bill but scheduled will also be visible in the physician module.

User will login to the Hospital HIS Application by giving valid username and password. User will click on the Physician Box. A popup window is displayed allowing the user to select the Location and the Station. User` selects the Location and the Station from the drop down and clicks on the OK button. "Scheduled Patient" screen will be displayed. Records with "Yes" in the visited column indicate patient has been visited to the doctor. Double click on the patient record to see patient history and to enter advice, investigation and other clinical detail of the patient.

OP patients that have paid bill but not visited the doctors are visible in the below screen based on the date selected. Physician and their assistants will see only those patients who have selected them as the consulting doctor in OP module.

"Patient Folder" to see the previous visits of the patient and the results of the various tests performed on the patient. Click on the "Print" button to print "Prescription" or "Complete Summary" of the patient. "Prescription" and "Complete Summary can be configured from the "Screen Configuration" option under the "Masters" module. Click on the "Screen Configuration" menu item under the "Masters" menu to configure the screen based on the "Specialization". Click on the 'Print Configuration" menu item under the "Masters" menu to configure the doctor's signature below the doctor's prescription. Click on the "Assistant mapping" menu item under the "Masters" menu to map assistant to the selected physician. After mapping "Assistant can also see the patients who have select that particular physician for consultation.

The Physician module of HIS,

- Capture and Save Patient Details
- Print Configuration
- Assistant Mapping
- Patient Folder

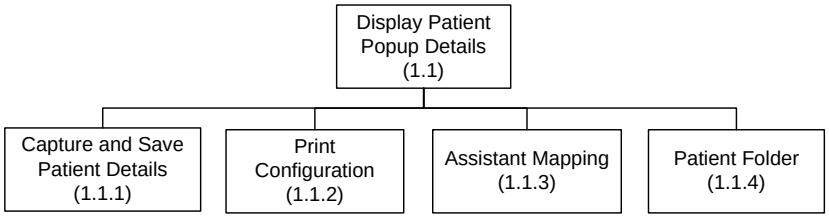


Figure 2.Information captured by HIS Physician Module

When a user login in the physician module at a location, by default it shows the list of patient scheduled for the doctor (logged in doctor/assistant) to be consulted on current date. If the user is a doctor, user can see only his/her patients. If the user is an assistant, he/she can see the list of patients for all doctor for which he/she is mapped as assistant.

Select date range as “From Date” and “To Date” from date controls to specify duration for wich list of scheduled patients is required. (Time duration can be more than 30 days)

Select “Patients List” to see list of patient scheduled for the doctor to be consulted or select “Patient Scheduled but not seen” to see list of patient scheduled for doctor but not yet consulted the doctor. Click on “View” button, to see list of patient for selected options.

If there is no patient scheduled for selected period (for logged in Doctor/assistant), the application will prompt “No patient for the selected duration”

And if patients are available for selected duration, then list will be populated This list contains patient visit status, patient name, patient age, patient sex, Patient referred by, Billed date time, Doctor, Patient phone no, package name (If any assigned).

The above list shows details using different Legend colors as different category. The patient list categorized as Visited patient, PHC patient, PHC Visited patient, package patient and visited package patient.

When the doctor/assistant clicks on the patient a new screen called “Visits” appears, where he/she saves information about patient, if patient has already visited then this window will contain information about patient’s old visit. Else if, the patient is visiting for the first time, then, doctor/assistant will insert all information about patient.

"Visits" screen shows department wise configuration of patient details like **Vital, Other History (Allergies and Habits), Chief Complaints, Physical Examination, Diagnosis, Investigations, Medication, Advise, Prescriptions Templates, Pathology Reports and Images.** The vital of patient used to keep track of general information of patient like Blood Pressure, Height, and weight. Uses slide bar to set the value for "Blood Pressure" of the patient and insert "Height" & "Weight" in respective textboxes.

Click on "Update" button is used to update the value of patient vitals. When user clicks on "View Previous Visits", then detail of previous visit of patient is shown. "Patient folder" is used to get all detail of patient as test detail, visit detail and Other Detail of patient. "Vital Report" is used to get vital report of patient.

"Other history" category is defined in two portions "Allergies & Habits" and "History".

"Allergies & habits" used to capture and update details of drug allergies, food allergies, other allergies and Habits of patient.

"Drug allergies" contains information about drug allergies of the patient. Click on the button next to the drug allergies text fields to get list of all stored drug allergies "Food allergies" contains information about food allergies of the patient. Click on the button next to the food allergies text fields to get list of all stored food allergies. Other allergies save information about allergies other than drug and food allergies of patient.

Habits will store information about the habit of patient as Smoking, Drinking etc.When user clicks on "Update" Button, all information about allergies and habits of patient get updated.

On the click of button next to the "Drug Allergies" text field and similarly the allergies can also be inserted into "Drug Allergies" by double clicking on the drug in the list.

"History" is used to capture and update medical history of patient. Insert details in the text filed provided to insert patient's history.

The screen also shows four major diseases "Cancer", "Heart disease", "Diabetes", and "Asthma" to take information "is any relative of patient is suffering / suffered from these illnesses". When user chooses "Yes" in radio box for any disease, drop box for relation gets enabled to choose relation with patient. In case of "No" the relation drop box will remain disabled.

Next screens used are to capture and update detail of “Chief Complaints” for patients. Insert “Chief Complaints” in the text field or click on “Favorite” button, to open list of template chief complaints created according to the doctor. On click of “Update” button, chief complaints information about patient get saved/updated.
On the click of “Favorites” button, Favorites pop up appears with list of template chief complaints created according to the doctor. Doctor can choose chief complaints from this list of template chief complaints. Tick on the check box of template to be selected and click on “Ok” button to add it to the Chief Complaint text field

Insert “Physical Examination” in the text field or click on “Favorite” button, to open list of template physical examination created according to the doctor On click of “Update” button the information about patient get updated.

The next screen is use to capture and update detail of “Patient Diagnosis”. The diagnosis is divided into two parts “Provisional” and “Final” diagnosis. Insert disease diagnosed of patient in the text field for diagnosis. Click on “Disease Codes” button, to get all disease codes information with their ICD Codes. Click on “Favorites” button, to get list of favorite disease code Doctor/Assistant has to select ICD Codes from the list for diagnosis, favorite diagnosis list. On click of “Update” button information about patient get updated.

On the click of “Diseases Codes” button appears to select the disease and insert into Provisional or final diagnosis text field by double clicking on the disease in the list.

The next screen is use to capture and update detail of “Patient Investigation”. Click on “Investigation” button, to get list of all saved investigations. Click on “Favorites” button, to get list of his/her favorite investigations. Click on “Update” button, to update information about patient in the database.

The next screen is use to capture and update detail of “Medicine” prescribed to patient. This screen is used to give drug information about drug prescribed to patient. On click of “Formulary drugs” button, list of formulary drugs appears. Doctor/Assistant can choose drug from drug list. On click of “Favorites” list of favorite's drugs of doctor appears. Insert “Dosage” for prescribed drug for patient. On click of “Update” button, information about drug prescribed to patient get updated.

The next screen is use to capture and update detail of “Advise” for patient. This screen shows and updates special advice for patient. Click on “Favorite” button, to get list of favorite advice of Doctor. By checking “Next Visit” check box, user can choose next visit detail for patient if applicable. Click on “Update” button, to update information about advice.

II. **Flow Chart**

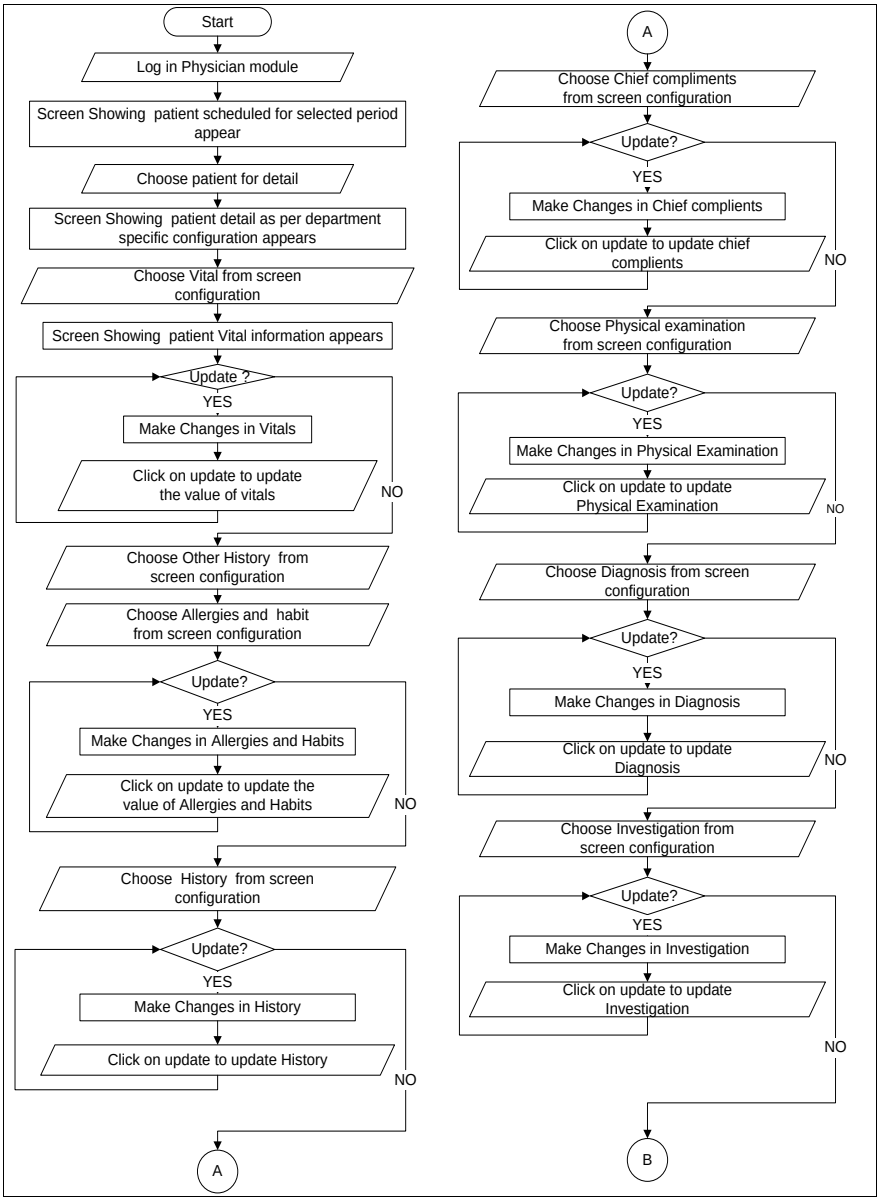


Figure 3.Work process Flow Chart 1

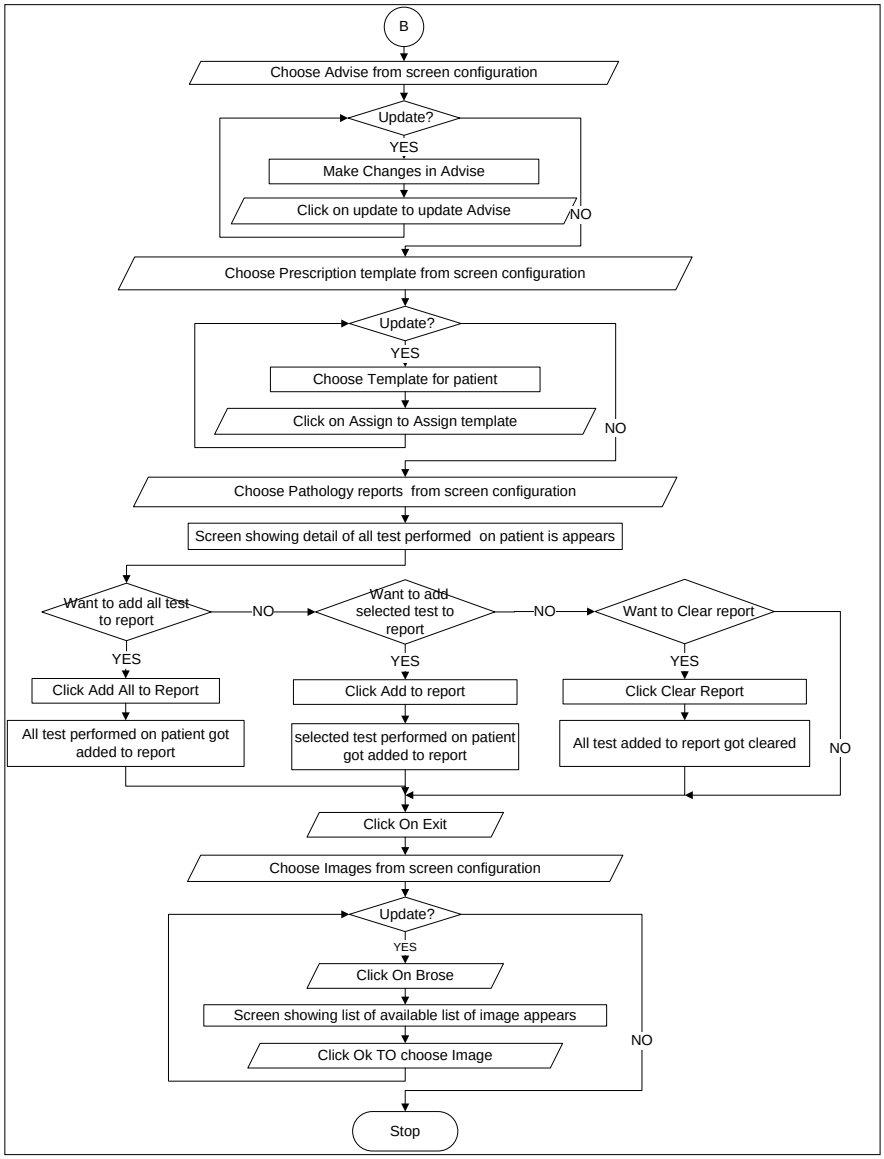


Figure 4.Work process Flow Chart 2

5.1 Benefits of HIS:

Current HIS is user-friendly and Physician staff is very much familiar with the GUI of the HIS.

Color coding facility helps the physician identify the patients waiting in the OPD which enhance their efficiency.

5.2. Bottlenecks of HIS:

Current HIS Physician module has very limited features available in it which is accounting for it minimal use by the doctors as they don't find it complete. Moreover it is not integrated to the various other modalities and hence again limiting its usage.

6.0.Review of Features of VistA CPRS Module:

The Computerized Patient Record System (CPRS) is a Veterans Health Information Systems and Technology Architecture (VistA) computer application. CPRS enables you to enter, review, and continuously update all the information connected with any patient. With CPRS, you can order lab tests, medications, diets, radiology tests and procedures, record a patient's allergies or adverse reactions to medications, request and track consults, enter progress notes, diagnoses, and treatments for each encounter, and enter discharge summaries[14]. In addition, CPRS supports clinical decision-making and enables you to review and analyze patient data.

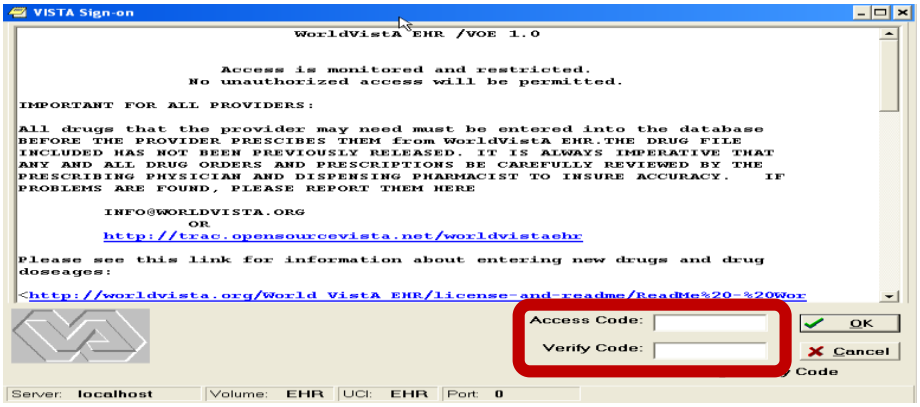


Figure 5.Screen showing access to the EHR / Signing in to CPRS

Type your access code into the Access Code field and press the Tab key. Type the verify code into the verify code field and press the Enter key or click OK. This ensures that no unauthorized access is permitted.

Once the user has entered the access code and verify code he is required to select a patient. After you log in to CPRS, the Patient Selection screen, is the first thing to appear. You should now select a patient record to view.

To select a patient record, follow these steps:

Type part of the patient's last name or the patient's entire name. CPRS will try to match what you entered to a patient and highlight that patient. The patient's name and other information will appear below the Cancel button.

With patient lists you can:

Quickly locate your patients without going through all the patients in the list. Create lists for teams of clinicians who can sign or cosign for each other.Tie notifications to teams, ensuring that all team members receive necessary information about a patient.To make it easier for you to locate your patients, CPRS enables you to set a default patient list.

Selecting a Patient

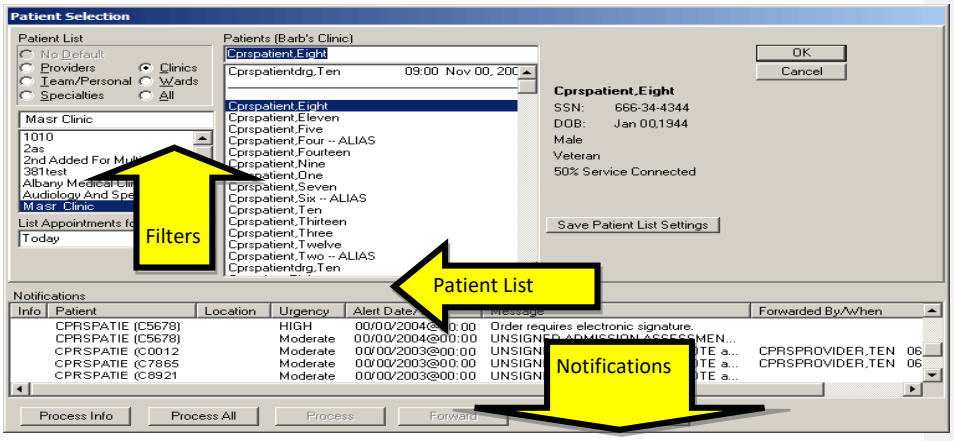


Figure 6.Screen showing Patient selection

Notifications

Notifications are messages that provide information or prompt you to act on a clinical event. Clinical events, such as a critical lab value or a change in orders trigger a notification to be sent to all recipients identified by the triggering package (such as Lab, CPRS, or Radiology). The notifications are located at the bottom of the Patient Selection screen.

CPRS places an "I" before "information-only" notifications. Once you view (process) information-only notifications, CPRS deletes them. When you process notifications that

require an action, such as signing an order, CPRS brings up the chart tab and the specific item (such as a note requiring a signature) that requires action.

From the main listing, users can also Remove Renew, or Forward notifications.

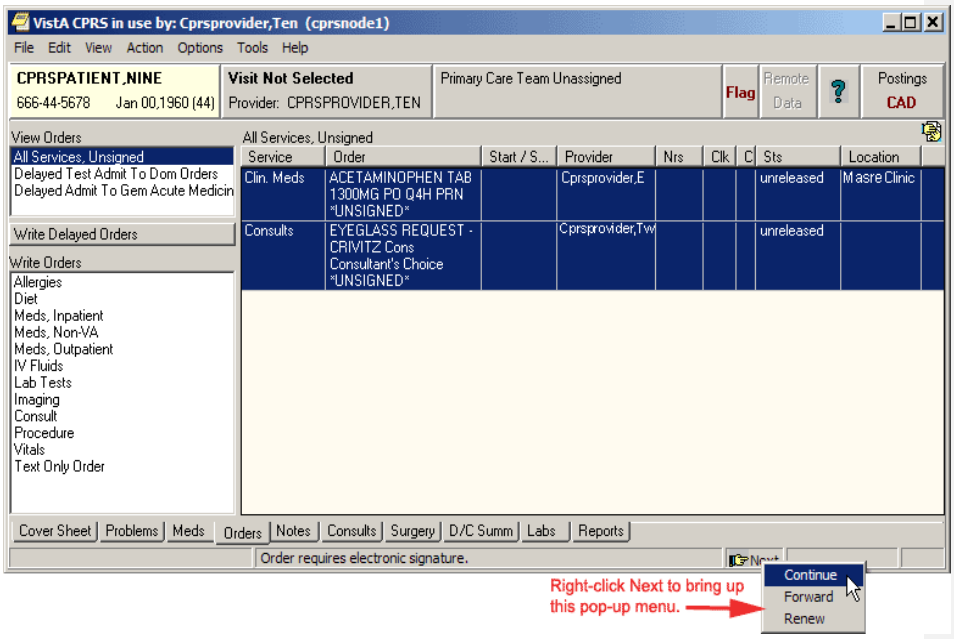


Figure 7.Order screen in VistA CPRS

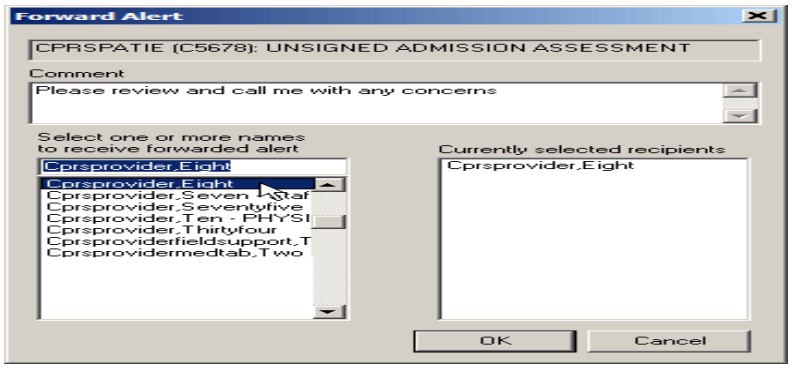


Figure 8.Alert message shown in VistA CPRS

Coversheet & CPRS Graphing

When you will click on the patient list, you will see the following screen. What is seen is the Cover sheet of the patient that you selected[6]. The dashboard look is designed to give you an overview of the patient which covers the following information about patient in one go

- Patient details
- Name of the provider
- Details of primary care physician or family physician, if any
- Flag, remote data, clock tabs; we'll discuss these in detail later
- Active problems: These are the record of active problems a patient may have if he is an old, established case
- Allergies /Adverse reactions: All the allergies/ adverse drug reactions etc will appear here
- Postings: Certain clinical notes may appear as postings.
- Active medications: this will list out the current medicines that the pt is receiving
- Clinical reminders: these are reminders set in past and appear here with their due dates. For e.g. periodic HBA1C test
- The lowest part of the dashboard looks like this
- Recent Lab Results: allows you to see the most recent lab test results for the patient
- Vitals: These are the current or the latest vital values recorded in the system
- Appointments/ visits: List of other appointments or visits
- The lowest aspect shows you a line of tabs. These tabs will allow you to see and control other aspects of patient care. We shall see them one by one.
- They are Problems, Meds, Orders, Notes, Consults, Surgery, Discharge summary, Labs, Reports
- Vitals, Appointments/Visits/Admissions

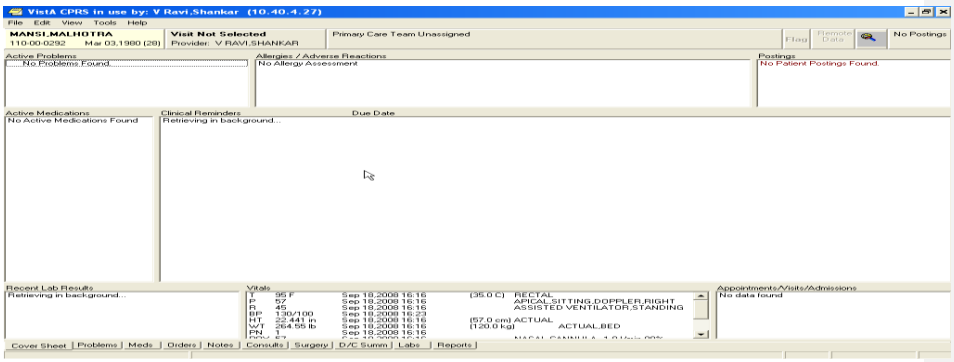


Figure 9.Coversheet in VistA CPRS

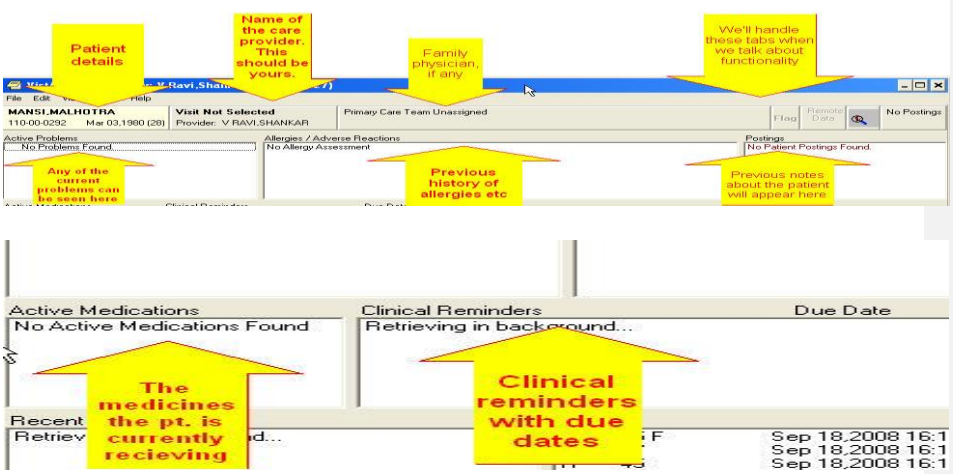


Figure 10.Coversheet in detail with explanation

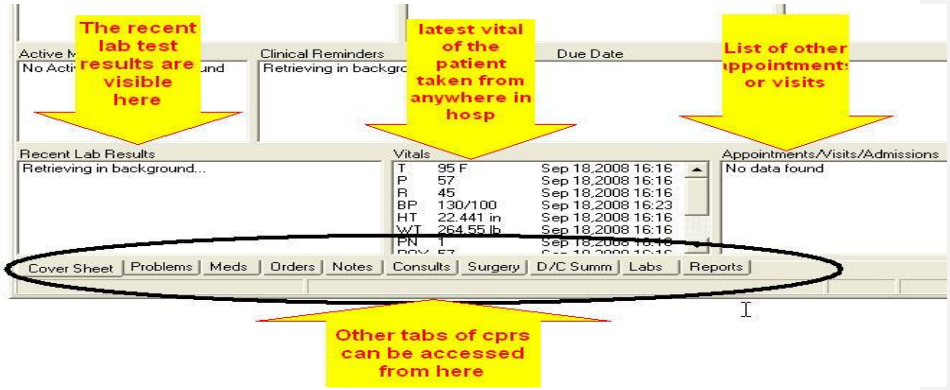


Figure 11.Tabs available on main coversheet of VistA CPRS

Cover Sheet Displays

On the Cover Sheet, the active problems display. Users can quickly see if the patient has any inactive codes for the active problems. The warning message instructs the user to correct the inactive code from the Problems tab. When the user closes the warning dialog, the detailed display then comes up. The detailed display also shows that the code is inactive.

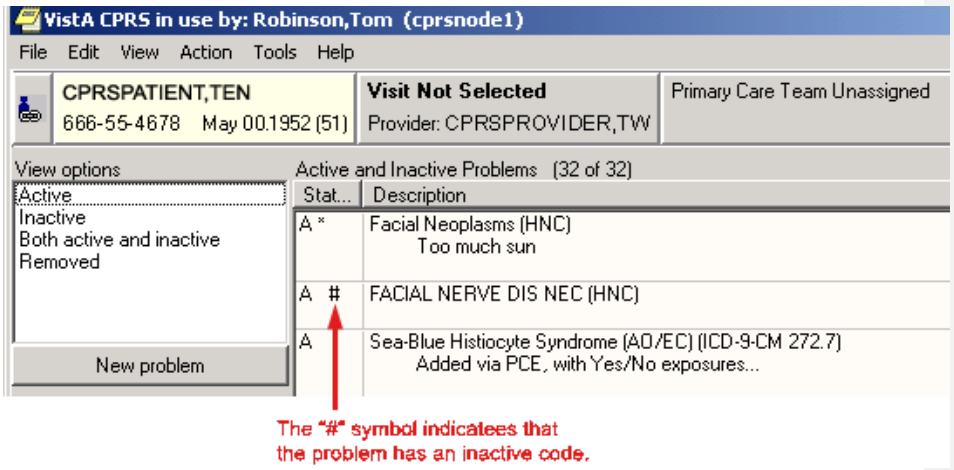


Figure 12.Problem screen in VistA CPRS

Encounter Information

To receive workload credit, you must enter the encounter form data, including the following information, for each encounter: Service connection, Provider name, Location, Date, Diagnosis, Procedure

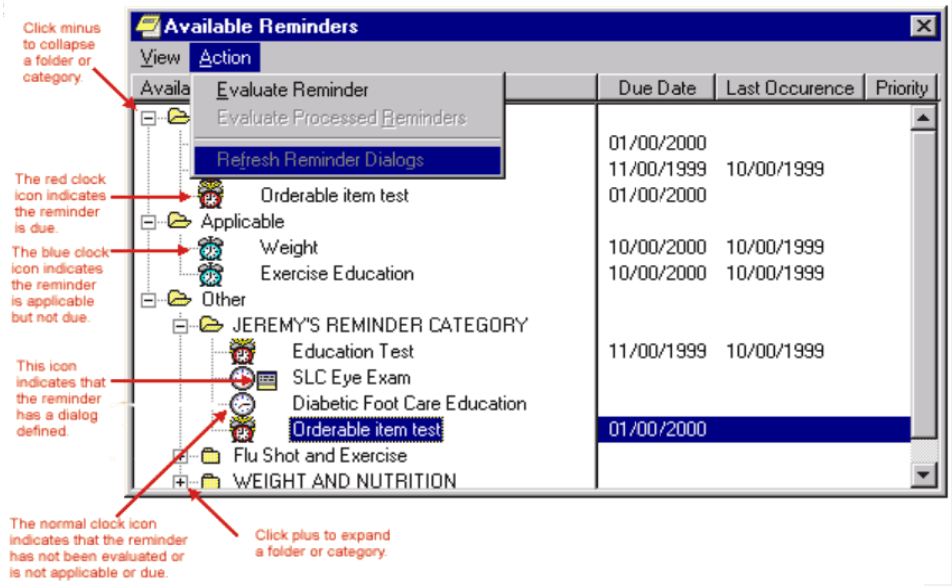


Figure 13.Clinical Reminder Screen in VistA CPRS

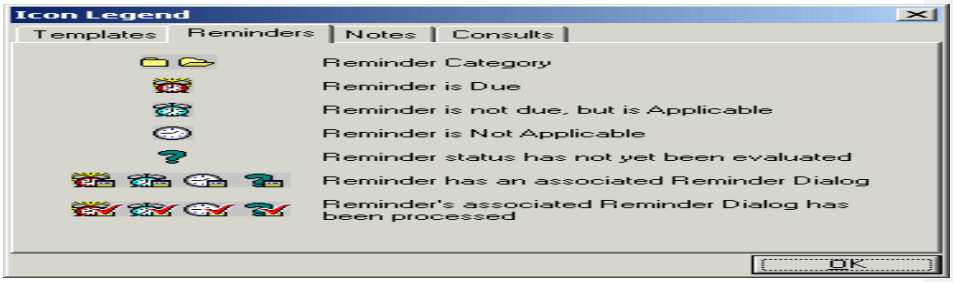
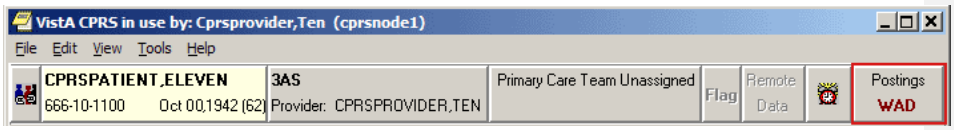


Figure 14.Icons for showing the reminder phase

Postings (CWAD)

Postings contain critical patient-related information about which hospital staffs need to be aware. The Postings button is visible on all tabs of the CPRS GUI window and is always located in the upper right corner of the window.

If a patient record contains postings, the Postings button displays one or more of the following letters: C, W, A, D. These letters correspond to the four types of postings described below.



C (Crisis Notes) – Cautionary information about critical behavior or patient health.
Example: Suicidal attempts or threats.

W (Warnings) – Notifications that inform medical center staff about possible risks associated with patients.
Example: Patient can be violent.

A (Adverse Reactions/Allergies) – Posting that displays information about medications, foods, and other items to which patients are allergic or to which they may have an adverse reaction. CPRS creates these postings automatically when users enter allergies.

D (Directives) – Also called advanced directives, directives are recorded agreements that a patient and/or family have made with the clinical staff.

Figure 15. Details of different posting options

click the Postings button or select View | Postings from the Cover Sheet tab.

CPRS displays a new window that contains the full text of the posting

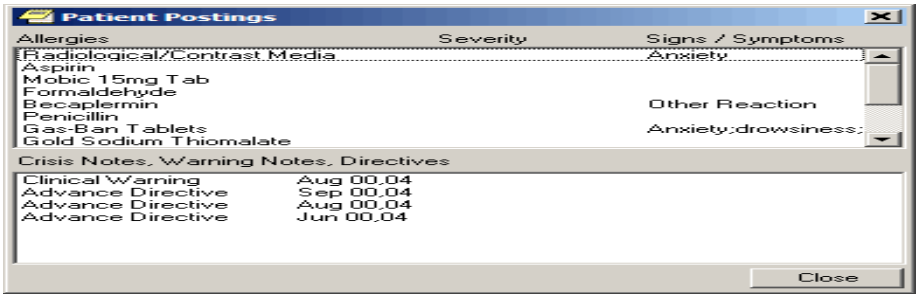


Figure 16.Screen capturing the allergies

CPRS Graphing

CPRS includes graphing functionality that enables you to create visual representations of relationships between many types of patient data. Specifically, CPRS graphing supports data from the following indexed sources:

Admissions, Allergies, Anatomic, pathology, Blood bank, Exams, Health factors, Immunizations

Lab tests, Medication, Medicine, Mental health

Notes, Orders, Patient education, Problems, Procedures, Purpose of visit, Radiology exams Registration, Skin tests, Surgery Visits, Vitals, Admissions and Visits

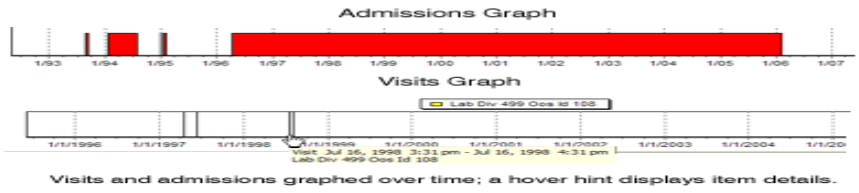


Figure 17.Screen showing the graphing in VistA CPRS

Vitals

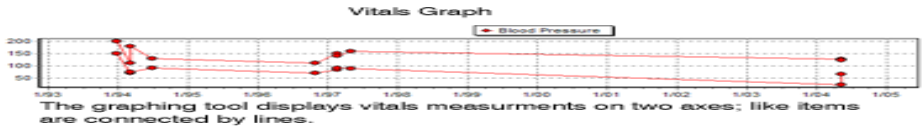


Figure 18.Patients vital graph

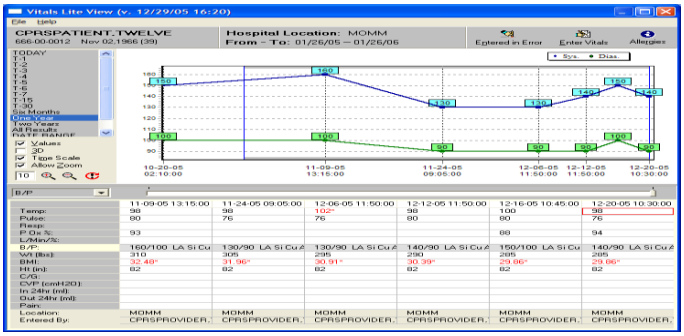


Figure 19.CPRS Displays Vitals

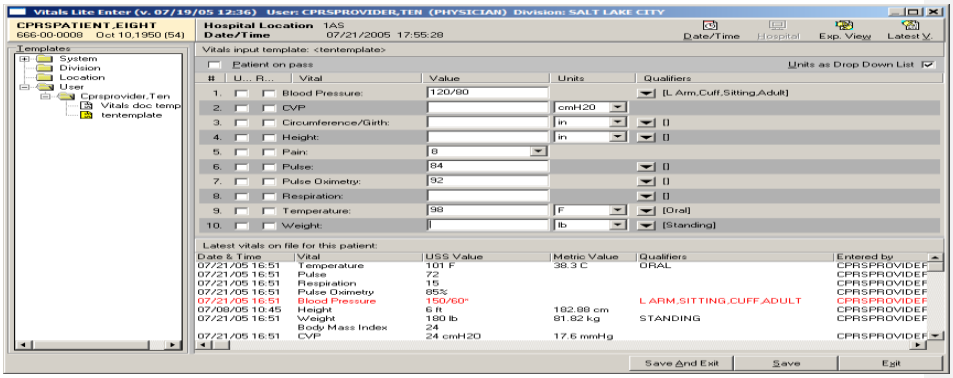


Figure 20.Recording Vitals

Electronic Signature

Electronic signatures, which have been available for some time, require an electronic signature code that can be created at your site.

An electronic signature is the private code that an authorized user types into the system after performing certain actions. For CPRS, it's used by clinicians entering orders. This signature has the same validity as the written signature on the chart. This is setup thru VistA roll and scroll application, using an option located under User's Toolbox.

7.0. Review of the requirement document:

1. The system shall display all current problems associated with a patient.
2. The system shall maintain a history of all problems associated with a patient.
3. The system shall provide the ability to maintain the onset date of the problem.
4. The system shall provide the ability to record the chronicity (chronic, acute/self-limiting, etc.) of a problem.
5. The system shall record the user ID and date of all updates to the problem list.
6. The system shall provide the ability to associate orders, medications, and notes with one or more problems.
7. The ICD codes shall be removed from problem list print outs if any.
8. The system shall provide the ability to filter, search or order notes by the provider who finalized the note.
9. The system shall provide templates for inputting data in a structured format as part of clinical documentation.
10. The system shall provide the ability to customize clinical templates.
11. The system shall provide the ability to record that patient specific instructions or educational material were provided to the patient.
12. The system shall provide the ability to modify the guidelines.
13. The system shall provide the ability to override guidelines.
14. Drug to drug interaction and any drug allergy noted should respectively be alerted by the system to the clinician, every time he prescribes a drug
15. The system shall provide the ability to create ailment specific care plan, protocol, and guideline documents.
16. The system shall provide the ability to document verbal/telephone communication into the patient record.
17. Chief Complaints and Diagnosis should be coded with ICD10.
18. The system shall provide the ability to designate certain note types, medications, tests, etc. as confidential and only make those values accessible by appropriately authorized users. The system shall provide the ability to prevent specified user(s) from accessing a designated patient's chart

19. The system shall audit the date/time and user of each instance when a patient chart is printed.
20. The system shall provide the ability to import data into the system.
21. The system shall provide the ability remove discrete patient identifiers.
22. The system shall provide the ability to track the intended destination (justification for extracting the data) of the extracted information. System does not do it.

7.1.Categorization of the Requirements:

- **Available in VistA(Color Code):** Green
- **Not available in VistA(Color Code):** Red

Out of the above mentioned requirements VistA CPRS module could support only requirements form 1 to 16 and the rest of the requirements were not being met with VistA.Out of a total of 181 requirements asked by the client the VistA could support only 126 work arounds were available for 40 and the requirements which were not fulfilled by VistA in total were 15.

8.0.PROJECT MANAGEMENT PLAN:

8.1.Change management plan:

The objective of this project is to implement VistA EHR in ABC Healthcare and ensure smooth and uninterrupted running of the same as this will enable the hospital to have a whole range of data in comprehensive form including patient demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images and billing information. This objective is set to be attained by the means of clinical transformation "a comprehensive ongoing approach to care delivery excellence that measurably improves quality, enhances service, and reduces costs through the effective alignment of people, process and technology.

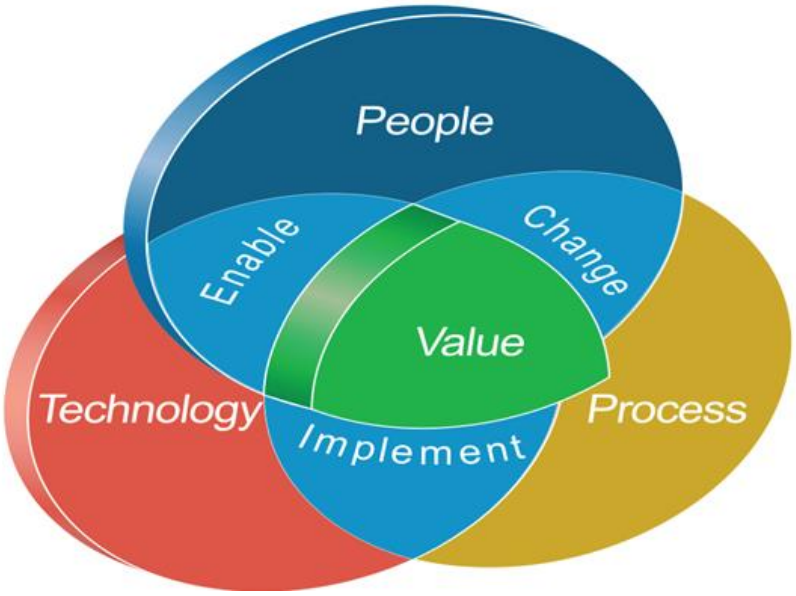


Figure 21. The clinical transformation triad

The measurable benefits of this transformation for the client, the clinicians, and the patients include:

- Increased safety through reduction of adverse medical events
- Increased quality through implementation of clinical best practices
- Decreased costs through identification of opportunities for improved operational efficiency
- Improved clinical adoption by effectively engaging clinicians
- Well defined metrics for success
- Improved clinical decision making, leading to accelerated process improvements throughout the organization

The goal is to attain the above stated benefits by means of clinical transformation

Dell is not only working with customers to successfully implement technology in their care environments, but is also striving to incorporate clinician adoption and benefits realization into these initiatives to ensure measurable success. For example, the early benefits of adding this performance improvement and tracking capability is the ability for nurses to perform 100 percent chart audits on admission and shift assessments. This capability and focus allows for improved care planning, reduced potential for omission of critical assessment information about the patient, and dramatically improved compliance.

Clinician adoption rates:

Our perspective has developed as a result of that experience, which has seen a shift in the historical focus on the technical aspects of deployment to the current emphasis on adoption and value. In our view, healthcare transformation requires a fundamental and interconnected change in the structure and function of healthcare systems that will transform the characteristics of healthcare, resulting in optimized health and quality of life for all patient populations and added value for all stakeholders.

A Continuous Measurable Process:

We look at healthcare transformation as a continuous process that provides real measurable value, but poses significant challenges. First, transformation requires a substantial investment

of time, talent, and financial resources to be successful. Clinical systems and the needed hardware and infrastructure are expensive and require expertise for successful deployment and for the ongoing maintenance and updates that are necessary for continued benefits.

Second, a successful transformation effort needs to have precisely aligned critical success factors. The strategic drivers for the business and the stakeholders need to be well understood and the drivers for sustainability of the continuous process of improvement required for transformation need to be articulated. Success requires an unwavering focus on the structures and functions to be transformed with a clearly defined methodology, roadmap, and accountability for making the change happen. It is imperative that success is described in terms of value measures that are defined and validated.

Third, the continuous process of transformation is challenging to execute: the healthcare environment is dynamic, with changing regulatory requirements, practice variations, and reimbursement standards at the same time that there are entrenched practices and practitioners within organizations that are reluctant to change.

8.1.Risk management plan:

To protect their interest from different external and internal environmental factors (risks), experts feel there is a need to have a well-defined risk management strategy. Risk management in hospitals is thus emerging as a trend in quality today. Its practice entails coordinated and systematic measures taken by the hospital to ensure healthy outcomes. It is not only restricted to the patient and/or employee safety measures, but an effort also is made to deal with different contingencies arising within the hospital. The standardization and the accreditation drive, especially led by the international sector played a key role in sensitizing hospitals about the risk management concept in the recent years. Moreover, the rapid rise in the incidence of occupational hazards, avoidable mishaps, hospital malpractices, sentinel events and consumer litigations have re-emphasized the importance of having a comprehensive risk management programme in hospitals.

Components of Risk Management

The first step in the risk management implementation strategy is acknowledgement of the existing risk factors within the hospital system and processes. Analysis and evaluation of the

risk and prescribing a treatment plan along with a prophylactic contingency plan follow. A practical approach to risk management can be achieved by devising a structured care plan to each individual who is at risk[15].

Managing Project Risks

The risk management methodology comprises four parts:

- Identification and Analysis of Threats
- Risk Treatment
- Risk Monitoring
- Risk Management Procedures.

Identification of threats

Threats are defined as events that, should they occur, will limit ability to successfully achieve the project objectives.

- Consideration of the threats against each of the objectives identified in the Project Management Plan
- Consideration of the threats in terms of Project Milestones, Deliverable and Tasks that they affect

Risk Analysis

The objectives of analysis are to separate the low (acceptable) risks from the high (unacceptable) risks; and to provide data to assist in the evaluation and treatment of risks.

Qualitative measures are considered to determine the Likelihood of a threat occurring and its consequence and in the last maginitude of the effect due to a combination of likelihood and condsequences.

Level	Likelihood	Amplification
A	Almost certain	You expect the risk to occur in almost all circumstances; or, in the given circumstance, it will almost certainly occur.
B	Likely	You believe that the risk will probably occur in the majority of circumstances; or, in the given circumstance, the likelihood is high.
C	Possible	You think that the risk might occur in some circumstances; or, in the given circumstance, there is a reasonable chance the risk will occur.
D	Unlikely	You think the risk might occur in occasional circumstances; or, in the given circumstance, the likelihood is low.
E	Remote	You believe the risk will only occur in exceptional circumstances.

Table 4.Risk Assessment Matrix

Rating		**Innovation**
5	**Catastrophic**	protracted failure of technology
4	**Major**	key technology ineffective or unavailable too long/frequently to consistently meet business requirements decision-making process on major issues impaired by inadequate information or data quality
3	**Moderate**	Systems not integrated – impairment to business inefficiencies decision-making process on day to day operational issues impaired by inadequate information or data quality
2	**Minor**	Occasional breakdowns in technology – causing some delay infrequently
1	**Insignificant**	very minor lapses in system effectiveness

Table 5.Risk assessment consequences

Magnitude

The magnitude is defined by a combination of likelihood and consequence, as follows:

Risk Analysis Matrix - Level of Risk					
Likelihood	Consequence				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A Almost certain	S	S	H	H	H
B Likely	M	S	S	H	H
C Possible	L	M	S	H	H
D Unlikely	L	L	M	S	H
E Remote	L	L	M	S	S

Table 6.Risk analysis matrix-Level of risk

High	Major impact on the objective of the project is seeking to achieve or on the critical success factors.**Needs to be addressed as a priority** (even if only means accepting the risk if no action is possible).
Significant	**Probably unacceptable.** Serious consequences for the project objective is seeking to achieve or for critical success factors; or likely to occur too often. **Attention is required soon or during planning**.
Moderate	**May need attention in order to protect** or enhance the objective or critical success factors. Or may accept, as not cost effective to take action.
Low	**Probably acceptable**. Minimal impact on the objective or critical success factors. Any action to further lower the risk is low priority

Table 7.Guide to Acceptability

Risk Treatment

Risk treatment involves identifying the range of options for treating risk,assessing those options and then establishing agreed controls.

Risk treatment options include:

- **Mitigation**: Reduce the potential Consequence or Likelihood
- **Abatement**: Pass the identified risk to someone else
- **Actuary Adjustment**: Allocate funds to cover the risk

Documentation

The completed Risk Analysis and Risk Treatment is documented in the Risk Register.Deadlines for the execution of Risk Controls are scheduled in accordance with project management procedures. An escalation process will occur for risks rated as high or

significant which are not effectively treated within an acceptable timeframe.

8.0.Conclusion and Recommendations:

Comparative analysis of the features available in HIS Physician module and VistA CPRS Module and simultaneously suggesting features which an ideal physician module should have:

Features	Vista CPRS	HIS Physician Module	Ideal Physician Module
A Real-Time Order Checking System that alerts clinicians during the ordering session that a possible problem could exist if the order is processed	Available	Not Available	Present
Notification System that immediately alerts clinicians about clinically significant events.	Available	Not Available	Present
A Patient Posting System, displayed on every CPRS screen that alerts clinicians to issues related specifically to the patient, including crisis notes, warning, adverse reactions, and advance directives;	Available	Not Available	Present
Remote Data View functionality that allows clinicians to view a patient's medical history from other hospital facilities to ensure the clinician have access to all	Available	Not Available	Present

clinically relevant data available across Hospital chain.			
Ability to place orders, including medications, special procedures, x-rays, patient care nursing orders, diets, and laboratory tests.	Available	Not Available	Present
Orders are checked for potential errors, interactions, adverse effects, and potentially integrated with knowledge database.	Available	Not Available	Present
Prompts that warn against the possibility of drug interaction, allergy, or overdose	Available	Not Available	Present
Provides a consistent, event-driven, graphic user interface.	Available	Not Available	Present
Accurate current information	Available	Not Available	Present
Drug specific information that eliminates confusion	Available	Not Available	Present
Disease specific rules	Available	Not Available	Present
Improved communication between physician, pharmacist, and nurses	Available	Not Available	Present
Reduced healthcare costs due to improved efficiencies	Available	Not Available	Present

Reduction of adverse drug effects (ADE)	Available	Not Available	Present
Standardization of treatment protocols	Available	Not Available	Present
Duplicate orders alerts	Available	Not Available	Present
Dose limits based on age, weight	Available	Not Available	Present
Contraindication/dose limit based on lab studies	Available	Not Available	Present
Cost of care recommendations	Available	Not Available	Present
Electronic signature	Available	Not Available	Present
Color coding facility	Not Available	Available	Present
Incorporation of BSA - Body Surface Area in the vitals menu	Not Available	Not Available	Present
Graphs / Trends for various scales used in physiotherapy like Lab	Not Available	Not Available	Present
Image/sketch library for documentation of lesion/procedure for record or explanation to patient.	Not Available	Not Available	Present
Equipment ordering for billing purposes has to have integration e.g. Alpha bed, BD pump, Ventilator.	Not Available	Not Available	Present

Provision to capture the referring physician (whether Client or non-Client) for conducting any radiological study.	Not Available	Available	Present
Family member records should be able to be linked together. Every patient record is individual and cannot be linked.	Not Available	Not Available	Present
The system shall display a schedule of patient appointments, populated either through data entry in the system itself or through an external application interoperating with the system.	Not Available	Available	Present
The system shall provide drug-disease interaction alerts.	Not Available	Not Available	Present
Automatically populating the data required once it has been entered into the system	Available	Not Available	Present
Provision to create favorite list of diagnosis, medications, investigations	Available	Available	Present
Automated Clinical Documentation			Present
Customizable Templates and Flow Sheets			Present
Built-in Decision Support Tools and Alerts			Present

Integrated Patient Education Protocols			Present
Outcome, Status and Quality Reporting			Present
Wireless and Internet Enabled			Present
Electronic Patient Chart			Present
Voice Recognition Integrated			Present
HL7 compatibility	Yes	Yes	Present
ICD 9 ,ICD 10	ICD 9	ICD 10	Present
CPOE(computerized physician order entry	Yes	No	Present

Table 8. Comparative analysis of HIS Physician module and VistA CPRS and suggesting an Ideal Physician module features

As from the above table it is very clear that the existing physician module has very few features and hence it limits the amount of data being captured and is being replaced by VistA CPRS module which organizes and presents timely, patient-centric information, such active problems, allergies, current medications, recent laboratory results, vital signs, hospitalization, and outpatient clinic history. The information is displayed immediately when a patient is selected and provides an accurate overview of the patient's current status before clinical interventions are ordered.

Electronic Medical Record is a secure, real-time, point-of-care, patient-centric application for clinicians that provides instant access to patient records and built-in decision support tools and alerts to aid clinicians in capturing decision-making rationale.IPM is a unique, customizable templates and flow sheets enable clinicians to automate and streamline their workflow and care for more patients. With IPM EMR software, clinicians can focus on what they do best: taking care of patients rather than paperwork. Moreover, IPM EMR software is fully and seamlessly should be integrated with medical billing software supporting collection of billing and financial data, as well as all image and document management for uses other than direct clinical care. Ultimately, immediate access to medical records with electronic medical records system ensures effectiveness and efficiency of healthcare services and from

the above table it is very clear that the ideal physician module should have all the features mentioned in the table above to be an efficient and effective source for documenting the patient details and providing quality care services to the patient[15].

Ability to automatically capture decision-making rationale in documenting the decision-making Processes, Ability to easily customize clinical templates in multiple views and generate flow sheets to view progress of patients over time in both text and graphical manner, while incorporating knowledge bases and outcomes tools to support direct monitoring and feedback of outcomes to clinicians. IPM EMR, therefore, as a predictive modeling application, captures patient's health related data to identify intensity of service for predictive resource allocation, real-time surveillance and alerting of potential adverse events. Such type of concurrent management-level care is facilitated by on-line displays enabling easy access to summary views and flow sheets of pertinent information for cohorts of patients (e.g., all patients on a specific care unit, all patients assigned to a particular case manager, all patients associated with a specific Physician or group, all patients with specific symptoms and demographics, etc.) to support detection and resolution of potential quality, staffing, and risk management issues. Furthermore, quality measures are enhanced by the provision of longitudinal and appropriately masked information to support clinical trials & research, public health reporting and population health initiatives. For example, decreased incidence of undetected signs and symptoms of impending deterioration of patient's condition and increased incidence of timely intervention. All in all, IPM EMR will assist the organization in meeting as well as maintaining excellent regulatory, safety and quality standards that will benefit both the care-receiver as well as the care-giver.

• Measurement, Monitoring and Analysis

• Aspect of Care Indicators

• Performance & Accountability Measures

• Predictive Resource Allocation

• Real-Time Surveillance

• Alerting of Potential Adverse Events

- Decreased Incidence of Undetected Signs
- Increased Incidence of Timely Intervention
- Safety & Regulatory Standards

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D.APPENDIX

Questionnaire 1:

Evaluation of use of and perception of the existing Hospital information System.

INTERVIEWER INSTRUCTIONS

"My name is…….I'm assisting the Dell Services to interview people working in Hospitals about their use of and perception of the existing Hospital information system and electronic Medical record VistA CPRS. The Information from this interview will help the Dell Services to develop and monitor a programme designed to implement the EHR successfully in different hospital setting keeping in mind the stakeholders expectations. You have been selected randomly from list of all the people who work with patient records in hospitals".

Confidentiality and consent: I'm going to ask you some questions on what you think about Hospital Information System and the Electronic Health Record. Your answers are completely confidential. Ill not ask your name and will not record it anywhere. Ill not tell anyone else your answers to the questions and hope that your honest answers will help us to develop a better programme.

I certify that the nature and purpose, the potential benefits associated with participating in this programme have been explained to the respondent.

SECTION 1: GENERAL ASSESSMENT

Q1. Job profile in your present organization

- Doctor
- Nurse

Q2. Does your hospital has Hospital Information System (HIS)?

- Yes
- No

Q3. How often do you use HIS?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q6. How much do you agree with the following statement "HIS is worth the time and effort required to use it"

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q5.Have you heard of VistA Electronic health record ?

- Yes
- No

SECTION 2: USABILITY EVALUATION OF HOSPITAL INFORMATION SYSTEMS(On the basis of "The IsoMetrics usability inventory (Gediga, Hamborg & Düntsch, 1999) provides a user-oriented, summative as well as formative approach to software evaluation on the basis of ISO 9241 Part 10).

Suitability for the task	A dialogue is suitable, if it supports the user to realise his tasks effectively and efficiently. Only those parts of the software are presented, which are necessary to fulfil the task.
Self-descriptiveness	A dialogue is self-descriptive, if every step is understandable in an intuitive way, or, in case of mistakes supported by immediate feedback. Further, an adequate support should be offered on demand.
Controllability	A dialogue is controllable, if the user is able to start the sequence and influence its direction as well as speed till he reached his aim.
Conformity with user expectations	A dialogue is conform with the user expectations, if it is consistent, complying with the characteristics of the user, e.g. taking into account the knowledge of the user in that special working area, accounting education and experience as well as general acknowledged conventions.
Error tolerance	A dialogue is error tolerant, if the intended deliverable is reached with no or just minimal additional effort despite of obvious faulty steering or wrong input.
Suitability for individualisation	A dialogue is suitable for individualisation, if the system allows customising according to the task as well as regarding the individual capabilities and preferences of a user.
Suitability for learning	A dialogue supports the suitability of learning, if the user is accompanied through different states of his learning process and the effort for learning is as low as possible.

Please refer to the details mentioned in the table and answer the following questions on a scale of 1 to 5

Q6. Suitability for the task

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q7. Self –descriptiveness

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q8. Controllability

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q9. Conformity with user expectations

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q10. Error tolerance

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q11. Suitability for individualization

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

Q12. Suitability for learning

1. Predominantly disagree 2. Slightly disagree 3. Neutral

4. Slightly agree 5. Predominantly agree

SECTION 3: ABOUT YOUR SATISFACTION WITH HIS IN YOUR DEPARTMENT

A. CONTENT

Q13. Does the system provide the precise information you need?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q14. Does the information content meet your needs

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q15. Does the system provide reports exactly the way you want

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q16. How often does the system provide sufficient information

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

B. ACCURACY

Q17. How often is the system accurate?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q18. How often are you satisfied with the accuracy of the system

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

C. FORMAT

Q19. How often do you think that the information is provided in the useful format

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q20. How often is the information clear?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

D. EASE OF USE

Q21.How often is the system user friendly

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q22. Ease of use with the system is

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

SECTION 4: ABOUT THE PERFORMANCE OF CLINICAL WORK TASKS WHEN USING AN HIS.

Q23. Does the system allow you to capture complete patient details?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q24. Does the system provide you with the entire patient record?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q25. How often you are able to diagnostic tests from the system?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q26. How often does the system provide alerts in case of adverse drug reactions or allergic Reactions?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always

Q27. How often do you use the clinical templates available in the HIS Physician module?

1. Almost never 2. Seldom 3. About half of the time

4. Most of the time 5. Almost always