A study on the process of resolving the incident affecting the Clients' business and their management after implementing EHR (Vista) in Superspeciality Hospitals

A dissertation submitted in partial fulfillment of the requirements

For the award of

Post-Graduate Diploma in Health and Hospital Management

By

Dr.Neelima Thakur

International Institute of Health Management Research

New Delhi -110075

February, 2012

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Under The Guidance Of

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Certificate of Internship Completion

Date:……..

TO WHOM IT MAY CONCERN

This is to certify that Dr. Neelima Thakur has successfully completed her 3 months internship in our organization from 5th September, 2011 to 5th December, 2011. During this internship she has worked on…… (Task performed) under the guidance of me and my team at Dell Services, Noida. (Any positive comment)…….

We wish her good luck for her future assignments.

(Signature)

_____(Name)

_____Designation

Certificate of Approval

The following dissertation titled "**A study on the process of resolving the incident affecting the Clients' business and their management after implementing EHR (Vista) in MAX Hospitals**" is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

Name	Signature
_____	_____
_____	_____
_____	_____

Certificate from Dissertation Advisory Committee

This is to certify that **Mrs. Neelima Thakur**, a participant of the **Post- Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. She is submitting this dissertation titled "A **study on the process of resolving the incident affecting the Clients' business and their management after implementing EHR (Vista) in MAX Hospitals"** in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

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

Faculty Advisor	Organizational Advisor
Designation	Designation
IIHMR	Organization
New Delhi	Address
Date	Date

Abstract

A study on post Go-live incident analysis and their management after implementation of EHR (VistA) in MAX Hospitals

By

Dr. Neelima Thakur

This project is based on the study of post Go-live incident analysis after implementation of EHR (VistA) in 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.

The Veterans Health Information Systems and Technology Architecture (VistA) is an enterprise-wide information system built around an electronic health record, used throughout the United States Department of Veterans Affairs (VA) medical system, known as the Veterans Health Administration (VHA).It is an integrated system of software applications that directly supports patient care. By providing electronic health records capability, VistA is thereby one of the most widely used EHRs in the world. 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.

The existing Hospital Information System (HIS) in the Hospital currently contains all the modules of Admission, Billing, Lab, Radiology, Pharmacy, Materials Management etc. The Hospital would like to implement VistA that can be integrated with the existing Hospital HIS to provide advanced clinical functionality which is limited in the current HIS.

So, Vista was implemented in the hospital which was integrated to the HIS for smooth functioning of the Hospital.The two different systems, HIS and VistA was integrated by means of an Integration Engine. The Open source Integration Engine Mirth is used

to send the messages between these two applications - HIS and VistA. Also, an HIS wrapper needs to be created to convert data from HIS into an HL7 message and vice versa.With the integration of the Hospital HIS and VistA, there is a need to maintain patient administration related data in both the systems. This data will be transferred at near real-time between the two systems in the form of HL7 messages. The integration engine is software which moves data between information systems. This process involves the transformation of data between messaging standards and requires support for multiple transmission protocols.

"Mirth's ability to support multi-channel messaging modes, multi-protocol connectors, multiple languages for transformer scripting, and a full complement of end-point technologies make it an attractive interface engine for VistA-based solutions,"

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

After implementation of EHR (VistA), it is important to keep it alive .No EHR is a static that once deployed will keep on working without routine care and maintenance. There are numerous tasks that need to be undertaken on a daily or weekly basis. Integrating the EHR into an organization after a successful launch presents its own unique challenges. Continuing to ensure system integrity, organization compliance and overall usability will decide the eventual outcome of this huge investment. Success or failure will largely depend on the amount of support an organization provides as the months stretch into years.
Initial success in EHR implementation is often dependent on how the considerable change management stresses are dealt with that is evaluation, monitoring and tracking of the progress of implementation and also there is a systems to track incidents and problems with a process in place to resolve them.

The purpose of this project is to study how to quickly resolve the incidents affecting the Clients' business. Any event which is not part of the standard operation of a service and which causes, or may cause, an interruption to, or a reduction in, the

quality of that service is known as incidents. Incident Management performs the capture, documentation, management and resolution of disruptions of service to the environment. The primary goal of Incident Management is to restore service as quickly as possible with the least impact to business operations. Recognizing that there are both technical and social aspects at work in EHR implementation, it must be seen that the technology and the organization transform each other during the process. Even with a well-planned implementation, the process can actually take on a life of its own, and a system for flexibility is essential.

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Acronyms/Abbreviations/Key-Words

- ✓ CPRS COMPUTERIZED PATIENT RECORD SYSTEM
- ✓ PIMS PATIENT INFORMATION MANAGEMENT SYSTEM
- ✓ EHR ELECTRONIC HEALTH RECORDS
- ✓ EMR ELECTRONIC MEDICAL RECORDS
- ✓ HL-7 HEALTH LEVEL-7
- ✓ HIS HOSPITAL INFORMATION SYSTEM
- ✓ PACS PICTURE ARCHIVAL AND COMMUNICATIONSYSTEM
- ✓ CPOE COMPUTERISED PATIENT ORDER ENTRY
- ✓ MAR MEDICATION ADMINISTRATION RECORDS
- ✓ 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
- ✓ IE INTEGRATION ENGINE
- ✓ API APPLICATION PROGRAMMING INTERFACE
- ✓ SCORM SHARABLE CONTENT OBJECT REFERANCE MODEL
- ✓ TAT TURN AROUND TIME
- ✓ AppOpsM APPLICATION OPERATIONS METHODOLOGY
- ✓ ITIL INFORMATION TECHNOLOGY INFRASTRUTURE LIBRARY
- ✓ OLA OPERATIONAL LEVEL AGREEMENTS
- ✓ OPAS OPERATIONAL PROCESS APPLICATION SUITE
- ✓ SMP SERVICE MANAGEMENT PLAN
- ✓ SLA SERVICE LEVEL AGGREMENT
- ✓ SD SERVICE DESK

Glossary

Diagnosis	A stage in the Incident and Problem Lifecycles. The purpose of Diagnosis is to identify a Workaround for an Incident or the Root Cause of a Problem.
Escalation	An Activity that obtains additional Resources when these are needed to meet Service Level Targets or Customer expectations. Escalation may be needed within any IT Service Management Process, but is most commonly associated with Incident Management, Problem Management and the management of Customer complaints. There are two types of Escalation, Functional Escalation and Hierarchic Escalation.
Incident	An unplanned interruption to an IT Service or a reduction in the Quality of an IT Service. Failure of a Configuration Item that has not yet impacted Service is also an Incident. For example Failure of one disk from a mirror set.
Incident Management	The Process responsible for managing the Lifecycle of all Incidents. The primary Objective of Incident Management is to return the IT Service to Users as quickly as possible.
Incident Record	A Record containing the details of an Incident. Each Incident record documents the Lifecycle of a single Incident.
IT Infrastructure	All of the hardware, software, networks, facilities etc. that are required to Develop, Test, deliver, Monitor, Control or support IT Services. The term IT Infrastructure includes all of the Information Technology but not the associated people, Processes and documentation.
Known Error	A Problem that has a documented Root Cause and a Workaround. Known Errors are created and managed throughout their Lifecycle by Problem Management. Known Errors may also be identified by Development or Suppliers.
Monitoring	Repeated observation of a Configuration Item, IT Service or Process to detect Events and to ensure that the current status is known.
Restore	Taking action to return an IT Service to the Users after Repair and Recovery from an Incident. This is the primary Objective of Incident Management.
Role	A set of responsibilities, Activities and authorities granted to a person or team. A Role is defined in a Process. One person or team may have multiple Roles, for example the Roles of Configuration Manager and Change Manager may be carried out by a single person.
Service Level Agreement	An Agreement between an IT Service Provider and a Customer. The SLA describes the IT Service, documents Service Level Targets, and specifies the responsibilities of the IT Service Provider and the Customer. A single SLA may cover multiple IT Services or multiple Customers.
Validation	Validation ensures that service has been restored to the end user.

1 PART -1

1.1 INTERNSHIP REPORT

1.1.1 ORGANIZATIONAL PROFILE

Dell 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. For more than 26 years, Dell has empowered countries, communities, customers and people everywhere to use technology to realize their dreams. Customers trust it to deliver technology solutions that help them do and achieve more, whether they're at home, work, school or anywhere in their world.

On September 21, 2009, Perot Systems agreed to be acquired by Dell for $3.9 billion. The acquisition resulted in a compelling combination of two iconic information-technology brands. H. Ross Perot and eight associates founded Perot Systems in June 1988 after having sold Electronic Data System (EDS) to General Motors. Before its acquisition by Dell Inc., Perot Systems was a Fortune 1000 corporation with more than 23,000 associates and 2008 revenues of $2.8 billion. Perot Systems maintains offices in more than 25 countries around the world, including the United States, Europe, India, China and Mexico

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

The 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 Perot Systems' capabilities, including in the most dynamic customer segments, around the world
- Supplying leading Dell computer systems to even more Perot Systems customers

It provides a portfolio of services to help hospitals identify and take advantage of EHR through the implementation of EHR.

Healthcare delivery and administration continues to become more complex. Uncompensated care is on the rise, demographics are changing, and patients are demanding more for their healthcare dollars. All the while, there continues to be a shortage of healthcare professionals to address the ever-demanding needs of consumers and patients.

To meet these challenges, Dell Perot Systems provides the right combination of clinical and business process improvements, coupled with technology to help hospitals and health systems achieve an environment that is interconnected, streamlined, efficient, and patient-focused. Its vision for the healthcare industry is simple: It wants healthy people to successfully interact with a safe, efficient, and consumer-friendly healthcare system.

Their team of physicians, nurses, and clinicians, as well as healthcare consultants and technologists are experienced in end-to-end hospital operations and understand how to develop, design and implement processes and technologies that bring about real provider transformation. They apply their extensive experience and expertise for:

Clinical Transformation - Healthcare providers today are facing the challenges of increasing the quality of care delivery and enhancing services while reducing costs. By implementing advanced clinical systems combined with care transformation programs, organizations are finding ways to fund new change initiatives while improving quality. Dell Perot Systems joins with the staff to improve care delivery processes and achieve measurable results.

Information Technology Solutions — Operational performance can be improved only when information technology is planned, designed and implemented to support an efficient way of doing things. Dell Perot Systems can help improve the productivity and quality of your services, as well as enhance the usefulness of clinical, HR, patient accounting, and administrative applications. Their global technology capabilities and Solution Centers deliver concentrated expertise for Cerner, McKesson, Meditech, Lawson, and Siemens solutions to name a few. Implementing, integrating, and

supporting the right infrastructure automates clinical and administrative processes and in turn enhances the quality of care delivery

Revenue Cycle Solutions — Whether the organization is financially distressed, has limited access to capital, high volumes of low-yielding accounts, or simply wants to improve the overall performance of their revenue cycle, Dell Perot Systems has the expertise and solutions that improve all revenue cycle metrics, with the realization that increasing cash is key because it provides the financial resources that allow for improving patient care.

It delivers the best healthcare possible. Whether it is a hospital, health system, or physician practice providing care, a health plan paying for care, or an integral part of the healthcare supply chain, delivering the best healthcare possible requires to be responsive, efficient, accurate, and innovative in a constantly changing industry.

Every day around the globe, its mission is to provide the full spectrum of infrastructure, application, and business process solutions that are the best service possible. By leveraging expertise, they are able to provide the organizations with creative, integrated, and innovative solutions that best meet their tactical and strategic objectives. For 20 years, other organizations have put their trust in Dell Perot Systems to deliver solutions that improve the business of health so they can transform care.

1.1.2 Managerial Tasks

Management in all business and organizational activities is the act of getting people together to accomplish desired goals and objectives efficiently and effectively. Management comprises planning, organizing, staffing, leading or directing, and controlling an organization (a group of one or more people or entities) or effort for the purpose of accomplishing a goal. Because organizations can be viewed as systems, management can also be defined as human action, including design, to facilitate the production of useful outcomes from a system. This view opens the opportunity to 'manage' oneself, a pre-requisite to attempting to manage others.In the organization I performed different managerial tasks as organizing the future state workshops, designing the templates for capturing patient data by the physicians, arranged the different user screens according to their comfort, updated all the configurations and managed time to complete the given task in the given time.

1.1.3 Organizational Learnings

As a trainee in Dell Services, I have learnt many valuable things which will be useful for me further in my career. According to me Dell is an ideal start for me which anybody at my stage can think of. I have attained great learning through the esteemed organization and contributed to it in my own little way to meet organization goals.I was posted with the VistA CPRS Application Management Support team where i have learnt the various configurations, template designing, creating reminders and attaching them to reminder dialogs and many more things which are as follows:

- Resolving incidents.
- CPRS VistA – Created templates on CPRS
- Created Reminder Dialogues on roll and scroll (Cache)
- Created patient objects and health summaries
- Configured procedures on CPRS
- Configured Consults
- Created Users on CPRS
- Registered patients on roll and scroll
- Created appointments on roll and scroll
- Created Clinics on roll and scroll
- Created an institution on roll and scroll
- Created a hospital location
- Created a ward and division location
- Configured notifications
- Organized and attended future state workshops
- Configured Lab. tests
- Changed Patient's information
- Activated users
- Assigned keys to the users
- Changed provider's information like signature, access codes and verifying codes

Apart from these learning, I also got to know the work and organizational culture which is also a significant and integral part of an organization.

2 PART -2

2.1 DESSERTATION OVERVIEW

The dissertation is based on the project of implementation of EHR in the 8 hospitals in Delhi/NCR region. This report focuses on the process of post Go-live incident analysis and their management. The overview of the dissertation report is as follows.

2.1.1 Problem Statement

The problem is to quickly resolve the incidents affecting the Clients' business and minimize the adverse impact on business operations, thus ensuring that the best possible levels of service quality and availability are maintained.

2.1.2 Objective

The general and specific objectives of the project are as follows:

2.1.2.1 General Objective

To study the post Go- live incident analysis and their management by restoring service as quickly as possible with the least impact to business operations

2.1.2.2 Specific Objectives

The specific objectives are as following:

- Incident detection and recording
- Classification and initial support
- Investigation and diagnosis
- Resolution and recovery
- Incident closure
- Incident ownership, monitoring, tracking and communication
- Establish incident framework management
- Evaluation incident framework management

2.1.3 Scope of the Project

This project includes the process of incident analysis and their management which deals with the identification, management, and resolution of incidents that affect service quality and efficiency. It includes the tasks and steps required to research the incident tend to define a solution. Incident Management process is to restore Normal Service Operations as quickly as possible and minimize the adverse impact on business operations, thus ensuring that the best possible levels of service quality and availability are maintained and concludes with a recommendation, which may be a quick fix, a workaround, or a Request for Change (RFC) to a configured item in the environment or a proposal for a phased project to ensure reliability. Throughout the Incident Management process, information related to the problem is recorded and tracked.

2.1.4 Need of the Project

After implementation of EHR (VistA), it is important to keep it alive .No EHR is a static that once deployed will keep on working without routine care and maintenance. There are numerous tasks that need to be undertaken on a daily or weekly basis.

The need of this project is to:

- To study the severities of incidents
- To study how to quickly resolve the incidents affecting the Clients' business.
- To study the process of Root cause analysis and Request for Change
- To process and maintain the data in both the systems.

2.1.5 Benefits

- Updated Incident record (including resolution and/or Work-around)
- Resolved and closed Incidents
- Communication to Customers
- Management information (reports).
- Problem Management (Root cause analysis)
- Request for Changes to resolve Incidents.

- This study will give the idea that what all challenges can be faced ,when a US based software gets implemented in Indian Hospital. So that one can avoid those mistakes.
- Same information can be processed and maintained in both the systems.

2.1.6 Assumptions

Assumptions for the project are as follows:

- It is assumed that the people who participated in the interviews are well versed with the existing HIS and VistA modules and are personally involved in the integration process.
- The hospital adheres to the accrediting standards in order to ensure quality services to the patients
- The departments have well established workflow which is adhered properly.

2.1.7 Data Sources

The data sources for the project are as follows:

- OPAS
- OPAS Explorer (OE)
- Integration Requirements and Message profile documents of the organization.
- VistA Manual
- HIS Workflow (Client Hospital)
- HL7 training document from the organization
- VistA CPRS Manual
- Requirement Document of VistA-EHR CPRS Module v1.0 (organization)

2.1.8 Work Plan

The work plan of the project includes the activity tables and the Gantt charts.

The activity table for the overall project is as follows:

ACTIVITY	**TIME TAKEN**
Defining the Problem	6th SEP- 23th SEP 2011
Literature Survey	24th SEP- 8th OCT 2011
Methodology Adopted	9th OCT-16th OCT 2011
Data Collection	17th OCT-10th NOV 2011
Compilation and Analysis	11thNOV-24th NOV 2011
Documentation	25thNOV-6th DEC 2011

Table 1 Activity Table for the Project Plan

The Gant chart for the above activity table is as follows:

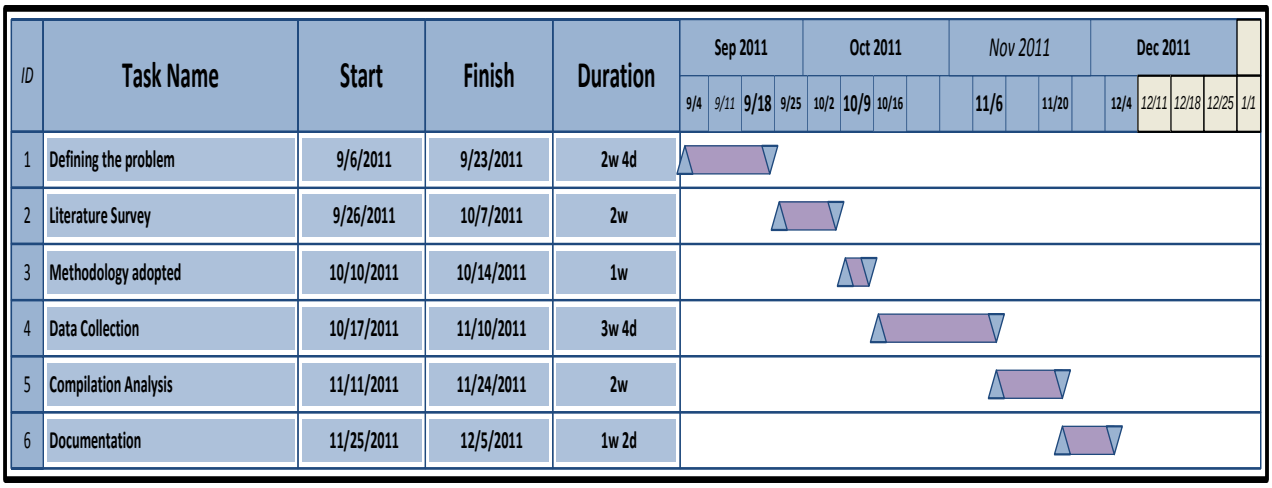


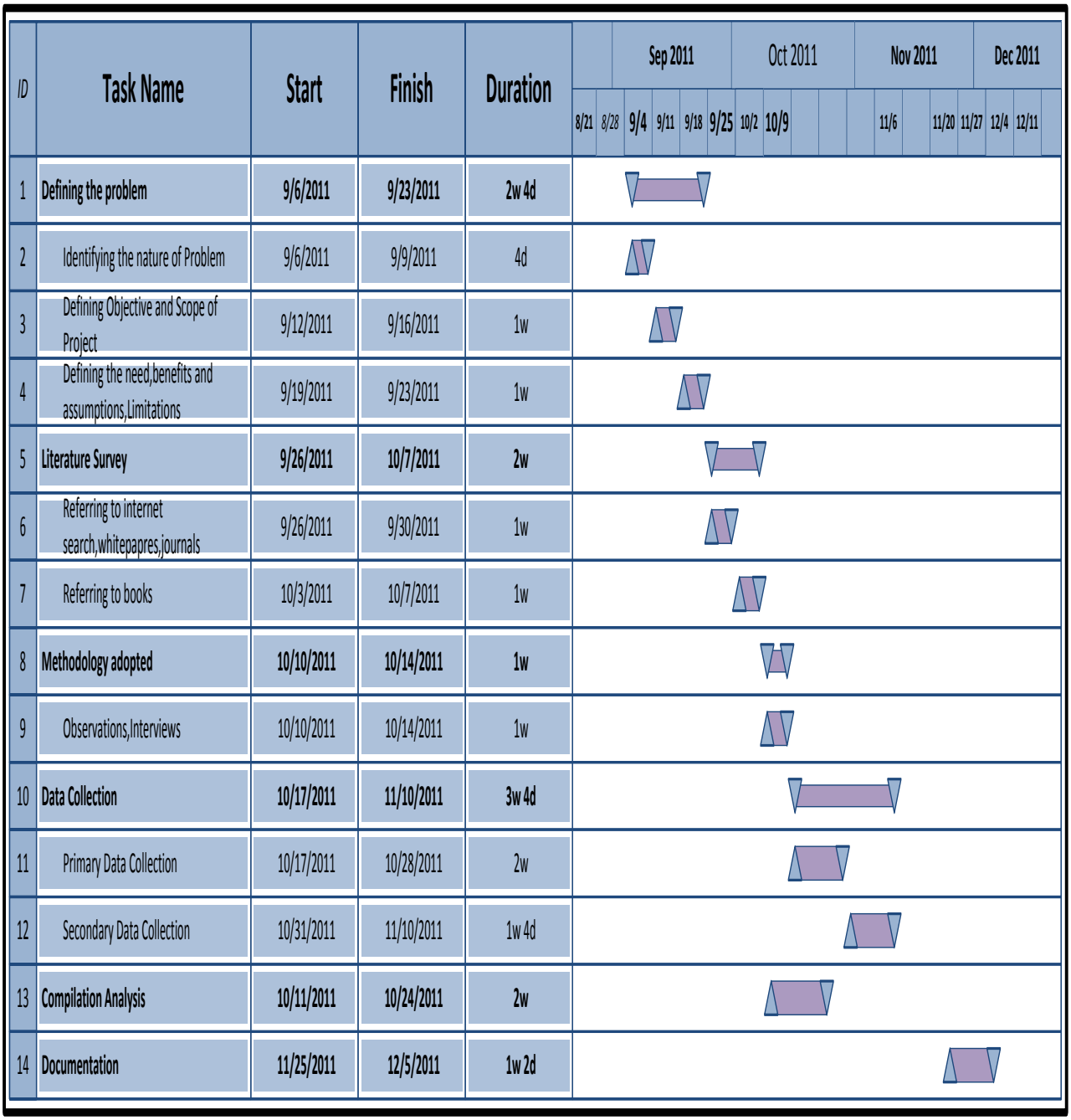
Figure 1. Gantt Chart for the Project Plan

The activity table for the detail work break down plan is as follows:

ACTIVITY	**TIME TAKEN**
Defining the Problem • Identifying the nature of problem • Defining the objective and scope of the project • Defining the need, benefits, assumptions and limitations.	**6th SEP– 23th SEP 2011** • 6th SEP – 9th SEP 2011 • 12th SEP – 16th SEP 2011 • 19thSEP– 23th SEP 2011
Literature Survey • Referring to internet search, white papers and journals. • Referring to books	**24th SEP- 8th OCT 2011** • 26th SEP – 30th SEPT 2011 • 3rd OCT– 7th OCT 2011
Methodology Adopted • Observations and Interviews	**9th OCT-16th OCT 2011** • 10th OCT – 14th OCT 2011
Data Collection • Primary data collection • Secondary data collection	**17th 0CT-10th NOV 2011** • 17th OCT – 28th OCT 2011 • 31th OCT – 10th NOV 2011
Compilation and Analysis	**11th NOV-24th NOV 2011**
Documentation	**25th NOV-5th DEC 2011**

Table 2 Work Break down Plan

The Gant chart for the above detailed work break down plan is as follows:



ID	Task Name	Start	Finish	Duration
1	**Defining the problem**	**9/6/2011**	**9/23/2011**	**2w 4d**
2	Identifying the nature of Problem	9/6/2011	9/9/2011	4d
3	Defining Objective and Scope of Project	9/12/2011	9/16/2011	1w
4	Defining the need,benefits and assumptions,Limitations	9/19/2011	9/23/2011	1w
5	**Literature Survey**	**9/26/2011**	**10/7/2011**	**2w**
6	Referring to internet search,whitepapres,journals	9/26/2011	9/30/2011	1w
7	Referring to books	10/3/2011	10/7/2011	1w
8	**Methodology adopted**	**10/10/2011**	**10/14/2011**	**1w**
9	Observations,Interviews	10/10/2011	10/14/2011	1w
10	**Data Collection**	**10/17/2011**	**11/10/2011**	**3w 4d**
11	Primary Data Collection	10/17/2011	10/28/2011	2w
12	Secondary Data Collection	10/31/2011	11/10/2011	1w 4d
13	**Compilation Analysis**	**10/11/2011**	**10/24/2011**	**2w**
14	**Documentation**	**11/25/2011**	**12/5/2011**	**1w 2d**

Figure 2. Gant Chart for the Work Break down Plan

2.1.9 Limitations

Due to confidentiality issues only part of the methodology could be adopted.

1. The secondary data collected were allowed to be used in a limited amount.
2. Certain readings of the client hospital were not allowed to be documented because of confidentiality issues.

2.2 PROJECT OVERVIEW

In today's world, information has been considered as a strategic source of power – empowerment to make timely informed decisions. This fact cannot be overemphasized in healthcare, where an informed decision can make the difference between life and death (or disability) for a patient. Incidentally, most often we find ourselves rich in data yet poor in tools required to convert it to information. The Indian healthcare system has recently realized the potential of information and communication technologies in completely transforming care delivery at hospitals.

This project is based on **study on post Go-live incident analysis and their management after implementation of EHR (VistA)** of 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. It is a truly automated system which has transformed their business processes into a near paperless system, controlling costs, saving time and thereby aiding in quick decision making and increasing the efficiency of the total system of the organization. This is possible as all the information is available online at any point of time. The information pertaining to the patient's previous visits, surgeries, diseases, allergies, lab reports, medication, etc. are available at his fingertips for analyzing and providing proper medication. In facilitating interoperability through standards, the hospital helps its members enhance, promote professional collaboration, and raise the level of patient care. HIS is used by this hospital for data records and activities that process the data and information.[2]

The EHR has been implemented in the Healthcare organization is VistA.

Once system is up and running, it is important to keep it alive .No EHR is a static that once deployed will keep on working without routine care and maintenance. There are numerous tasks that need to be undertaken on a daily or weekly basis.
Integrating the EHR into an organization after a successful launch presents its own unique challenges. Continuing to ensure system integrity, organization compliance and overall usability will decide the eventual outcome of this huge investment. Success or failure will largely depend on the amount of support an organization provides as the months stretch into years

Initial success in EHR implementation is often dependent on how the considerable change management stresses are dealt with that is evaluation, monitoring and tracking of the progress of implementation and also there is systems to track incidents and problems with a process in place to resolve them.

The purpose of this project is to study how to quickly resolve the incidents affecting the Clients' business. Any event which is not part of the standard operation of a service and which causes, or may cause, an interruption to, or a reduction in, the quality of that service is known as incidents. Incident Management performs the capture, documentation, management and resolution of disruptions of service to the environment. The primary goal of Incident Management is to restore service as quickly as possible with the least impact to business operations.

2.2.1 Introduction

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.

EHR may include a whole range of data in comprehensive or summary form, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, and billing information.

Advantages of an Electronic Health Record

- Easy access to information
- Comprehensive and standardized documentation
- Improved quality of patient care
- Increased nursing efficiency
- Improved process communication
- Reduced medication errors
- Reduced hospital costs
- Meet various accreditation requirements
- Promote evidence based medicine
- Improved patient's experience in the hospital
- Reduced TPA denials
- Better control of Management
- Reduced pilferages
- MIS reports

Rationale: To enhance care delivery excellence by measurably improving quality of service and reducing costs through the effective alignment of people, process and technology.

The EHR has been implemented in the Healthcare organization is VistA.

Veterans Health Information Systems and Technology Architecture (VistA)

The Veterans Health Information Systems and Technology Architecture (VistA) is an enterprise-wide information system built around an electronic health record, used throughout the United States Department of Veterans Affairs (VA) medical system, known as the Veterans Health Administration (VHA).[2]

This 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.[3]

By 2008, the VHA was the largest single medical system in the United States, providing care to 5 million veterans, employing 180,000 medical personnel and operating 163 hospitals, over 800 clinics and 135 nursing homes. By providing electronic health records capability, VistA is thereby one of the most widely used EHRs in the world. VistA supports both ambulatory and inpatient care.[2]

It was developed using the M or MUMPS language/database. The VA currently runs a majority of VistA systems on the proprietary Intersystem Cache version of MUMPS, but an open source MUMPS (Massachusetts General Hospital Utility Multi-Programming System) database engine, called GTM for Linux and Unix computers has also been developed. GTM is an implementation of the Standard M programming system (M = MUMPS = Massachusetts General Hospital Utility Multi-Programming System).[4]VistA is written in Standard M. GTM is an implementation of M from Fidelity Information Services. In addition, the free and open source nature of GTM allows redundant and cost-effective failsafe database implementations, increasing reliability for complex installations of VistA.[5]

Features of VistA

VistA is a collection of about 100 integrated software modules.[6]Some of the modules included in VistA which enables the user with a number of advantages are:

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.[7] This includes the ability to place orders, including those for medications, special procedures, X-rays, nursing interventions, diets, and laboratory tests.[8] 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).[9]

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.[3]

Radiology Module

Radiology / Nuclear Medicine package is a comprehensive software package, designed to assist with the functions related to processing patients for imaging examinations. The Radiology / Nuclear Medicine package automates the entire range of diagnostic functions performed in imaging departments, including request entries by clinical staff, registration of patients for exams, processing of exams, recording of reports/results, verification of reports on-line, displaying/printing results for clinical

staff, automatic tracking of requests/exams/reports, and generation of management statistics/reports, both recurring and ad hoc. The Radiology / Nuclear Medicine package automates many tedious tasks previously performed manually, providing faster, more efficient and accurate data entry and more timely results reporting.[3]

One of the important features provided by VistA is

VistA Imaging

The Veterans Administration has also developed VistA Imaging, a coordinated system for communicating with PACS (radiology imaging) systems and for integrating others types of image-based information, such as, pathology slides, and scanned documents, into the VistA electronic medical records system. This type of integration of information into a medical record is critical to efficient utilization.[5]

Surgery Module

The Surgery package is designed to be used by Surgeons, Surgical Residents, Anesthetists, Operating Room Nurses and other surgical staff. The Surgery package is part of the patient information system that stores data on the Department of Veterans Affairs (VA) patients who have, or are about to undergo, surgical procedures. This package integrates booking, clinical, and patient data to provide a variety of administrative and clinical reports.[3]

Pharmacy Module

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

VistA EHR also includes functionality tailored to meet the specific needs of clinics and physician offices, such as:

- 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 obstetrics/gynecology (OB/GYN) and pediatrics care
- Vista which was implemented in the healthcare organization was integrated to the following three for smooth functioning
- Home Hospital Information system (HIS)
- Picture Archival and Communication System (PACS)
- Lab analyzers

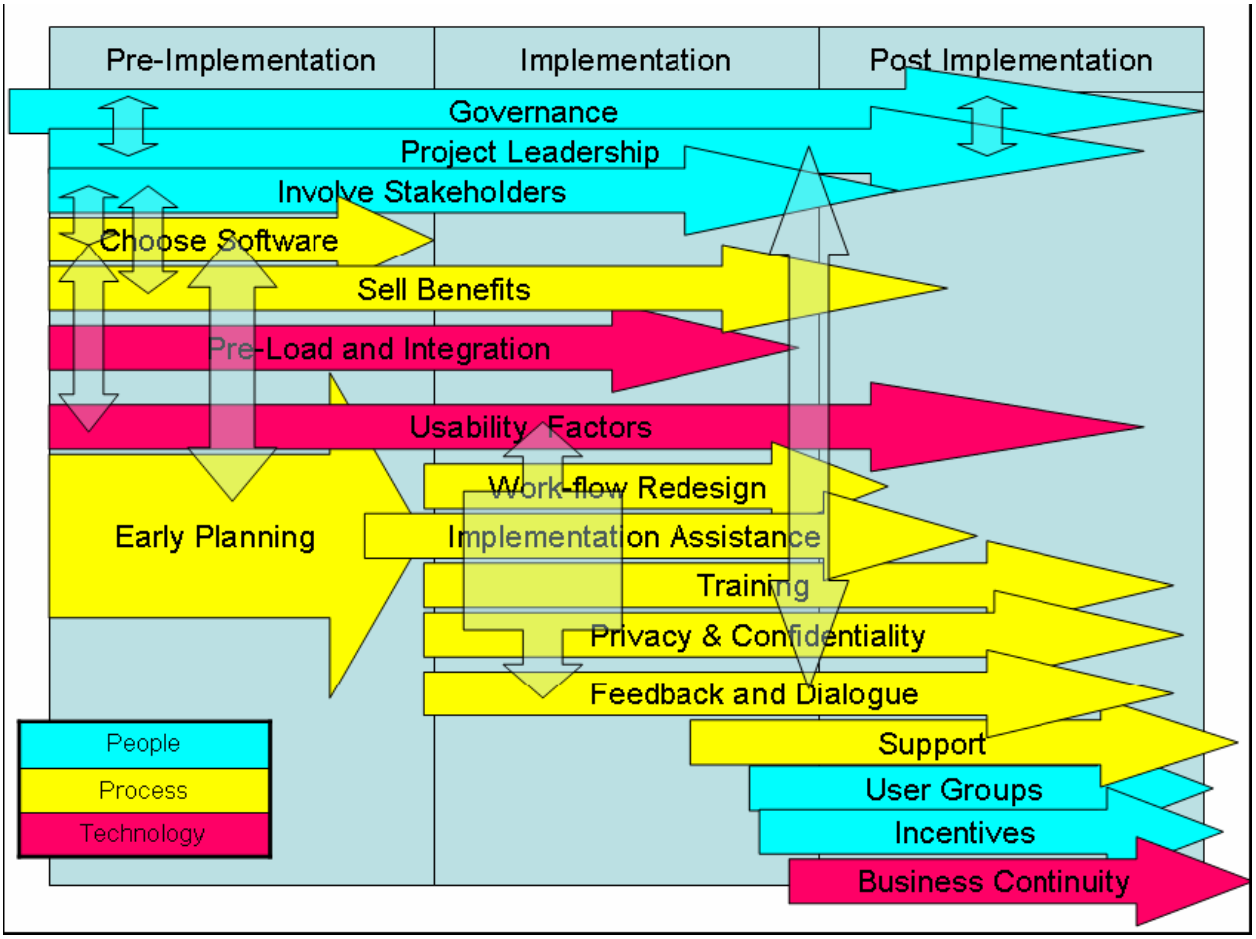


Figure 3. Phases and Tasks in EHR Implementation

After implementation of EHR user requires significant amount of support, especially in the early phases after implementation. A myriad questions and issues arise – some trivial and some substantial, but all can lead to disenchantment and disillusionment if not handled appropriately. A problem as simple as a user forgetting their password and not being able to resolve it can quickly make the whole system unusable for several people. For example, a receptionist who forgets a password cannot schedule new patients, making it difficult for physicians to bring up patient charts in a timely manner, creating gridlock and mayhem in a very short time period.

Recognizing that there are both technical and social aspects at work in EHR implementation, it must be seen that the technology and the organization transform each other during the process. Even with a well-planned implementation, the process can actually take on a life of its own, and a system for flexibility is essential.

The primary goal of the Incident Management process is to restore Normal Service Operations as quickly as possible and minimize the adverse impact on business operations, thus ensuring that the best possible levels of service quality and availability are maintained.

Background

The 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. The Hospital's experience has revealed quite a few insights to the reasons for adopting health informatics, expected end results and the hurdles on the way to achieving them.[12]

The Hospital group utilizes a Hospital Information System for the enterprise wide transaction handling and resource planning. A centralized database with an application running on server-client architecture promotes the aggregation of data from multiple hospitals and gives a unified view.[13]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. Business intelligence is beginning to play a larger role in the visibility of information and in its ability to drive objective and informed decisions, the ultimate aim of which is to deliver performance.[11] DICOM compatible diagnostic images acquired from CT, MRI, X-Ray, Ultrasound, Gamma Camera, Echo-cardiology, C-Arm etc. are archived and accessed from the PACS. Images can be viewed on Desktops using PACS Interface Software.

The existing Hospital Information System (HIS) in the Hospital currently contains all the modules of Admission, Billing, Lab, Radiology, Pharmacy, Materials Management etc. The Hospital had implemented VistA that was integrated with the

existing Hospital HIS to provide advanced clinical functionality which is limited in the current HIS.[12]

So, Vista was implemented in the hospital which needs to be integrated to the HIS for smooth functioning of the Hospital.

After implementation of EHR, it needs to provide continues application support and maintenance to record the incidents and resolve them as soon as possible. Those activities considered to be within the scope of the application Incident Management process are

- Service not available
- Application bug,

Application query preventing customer from working due to unavailability or slowness of application

The following types of support are in scope of this procedure:

- 1st line support : Project executes Service Desk function.
- 2nd line support: Project receives Tickets (Incident or Requests) from the (Service Desk and works on the Tickets or, if needed, sends them to 3rd line support, which in this case can be the customer or another supplier.
- 3rd line support : Team gets involved only if specialist application knowledge is required. This often is the case when code changes are needed.

In scope of this procedure are Incidents on the products/applications that are managed by Dell Perot Systems. An incident causes, or may cause an interruption to the (quality of) service that Dell Perot systems have promised to deliver.

2.2.2 Literature Survey

2.2.2.1 The challenge of electronic health records (EHRs) design and implementation

(By Jenkings KN, Wilson RG)

BACKGROUND AND AIM: To investigate the use of animation tools to aid visualization of problems for discussion within focus groups, in the context of healthcare workers discussing electronic health records (EHRs).

METHOD: Ten healthcare staff focus groups, held in a range of organizational contexts. Each focus group was in four stages: baseline discussion, animator presentation, post-animator discussion and questionnaire. Audio recordings of the focus groups were transcribed and coded and the emergent analytic themes analyzed for issues relating to EHR design and implementation. The data allowed a comparison of baseline and post-animator discussion.

RESULTS: The animator facilitated discussion about EHR issues and these were thematically coded as: Workload; Sharing Information; Access to Information; Record Content; Confidentiality; Patient Consent; and Implementation.

CONCLUSION: We illustrate that use of the animator in focus groups is one means to raise understanding about a proposed EHR development. The animator provided a visual 'probe' to support a more proactive and discursive localized approach to end-user concerns, which could be part of an effective stakeholder engagement and communication strategy crucial in any EHR or health informatics implementation program me. The results of the focus groups were to raise salient issues and concerns, many of which anticipated those that have emerged in the current NHS Connecting for Health Care Records program me in England. Potentially, animator-type technologies may facilitate the user ownership which other forms of dissemination appear to be failing to achieve.

2.2.2.2 Costs and benefits of health information technology

(By Shekelle PG, Morton SC, and 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.

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

(Cheick-OumarBagayoko, Jean-Charles Dufour, SaadChaacho, Omar Bouhaddou, and Marius Fieschi,DER Santé Publique, Faculté de Médecine, Pharmacie et d'Odonto-Stomatologie, Bamako, Mali,Laboratoired'Enseignement et de Recherchesur le Traitement de l'InformationMédicale, 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 Med board and an expanded implementation throughout the hospital.

2.2.2.4 Incident Management Teams as Vehicles of HRO Implementation

Background

In November 2007 Jason Greenlee, Fire Management Officer for the Bureau of Indian Affairs Navajo Office, contacted Anne Black, an interdisciplinary scientist working for the U.S. Forest Service, to inquire about her availability to conduct High Reliability Organizing (HRO) related training at the (Southwest Incident Management Teams 2008 Annual Meeting). Black had been working extensively with HRO and she and Greenlee had met when both were involved in workshops in the Managing the Unexpected series organized by the Wildland Fire Lessons Learned Center. In January 2008, five of the Southwest geographical area incident management teams approved the proposed HRO training as an element of their annual spring team meetings, and Black began the planning process by proposing content to the meeting organizers. Jeff Whitney, a Type 1 Incident Commander (IC) serving as one of the meeting planners, encouraged interpersonal communications elements proposed by Black, believing that this represented an area in which incident management teams could improve. Ultimately, all the involved ICs helped Black identify key content and learning objectives, while the initial focus on interpersonal communications remained the primary theme. Black built a small workshop team by soliciting involvement from a subset of an HRO community of practice that had been evolving over the previous five years as a result of the Wild land Fire Lessons Learned Center's series of HRO workshops. A five person team planned and conducted the training and was joined by a doctoral candidate from the University of California – Berkley, who served as an observer and evaluator.

Following the Southwest workshop, two wildland fire use (WFU) management teams in the Northern Rockies geographic area and the Forest Leadership Team of the Lolo National Forest requested similar training. Following the training efforts, several incident management teams expressed interest in follow-up coaching and mentoring in the field as they embarked on efforts to carry HRO concepts forward during the 2008 fire season. Both Black and David Christenson, of the Wildland Fire Lessons Learned Center, responded to these mentoring requests. Through the efforts described here, people created opportunities to use incident management teams as role models for consciously actualizing and operationalizing HRO principles, a strategy with

potential for rapidly transferring HRO principles to the broader wild land fire community.

High Reliability Organizing

Fire management represents a complex and inherently risky undertaking, in the course of which fire management personnel may confront many unexpected events, conditions and circumstances with the potential to escalate beyond their control. However, both research and experience have shown that certain organizations simultaneously operate in high-risk and high tempo environments, achieve their 2 operational objectives, and yet realize more acceptable levels of human error and accidents. Experts have called these “high reliability organizations” (HRO).HROs is organizations that create a mindful infrastructure

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

(BahlolRahimi, MSc,AnnaMoberg, PhD, ToomasTimpka, 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.

2.2.3 Data Collection

2.2.3.1 Methodology Adopted

The study involves the analysis of the primary as well as secondary data. This study involves the regular documentation and resolution of all the incident tickets reported in OPAS.Study also involves examining the current HIS modules and the VistA modules. For this study all the features of the Vista and HIS are studied carefully.

2.2.3.2 Type of Data

The data was collected by the following methods:

- Primary data collection - In primary data collection, the data is collected using methods such as interaction and observation, etc. The primary data, which is generated by the above methods, is qualitative in nature.
- Secondary data collection- The secondary data collected was quantitative in nature. OPAS (Operational Process Applications Suite).

2.2.3.3 Data collection tools

The different data collection tools are as follows:

- OPAS
- OPAS Explorer (OE)
- HIS Workflow (Client Hospital)
- HL7 training document from the organization
- Review of the requirement document for integration of HIS and VistA given by the organization.
- Review of VistA CPRS Manual.
- Observation of the features VistA CPRS module.
- Discussion with Application Support and Maintenance team.

2.2.3.4 Primary data collection

Primary data was collected through:

- Interaction with Application Support and Maintenance team.
- Interaction with Integration team and Configuration team.
- Observation and review of the features of HIS and VistA modules.
- Direct Observation of the work processes using existing HIS

2.2.3.5 Secondary data collection

Secondary data was collected through:

- Review of OPAS
- Review of HIS Manual.
- VistA CPRS user Manual
- Integration Requirements and Message profile documents of the organization.
- HL7 training document from the organization
- Requirement Document of VistA-EHR CPRS Module v1.0 (organization)
- Other books, papers, websites and articles.

2.2.4 Discussions

An incident is unplanned interruption to an IT Service or a reduction in the Quality of an IT Service or failure of a Configuration Item that has not yet impacted Service. For example Failure of one disk from a mirror set. The primary Objective of Incident Management is to return the IT Service to Users as quickly as possible.

2.2.4.1 Descriptions and Definitions

Definition	*Description*
Incident	Any event which is not part of the standard operation of a service and which causes, or may cause, an interruption to, or a reduction in, the quality of that service.
Incident Tracking System	This is an automated or a manual system used to support the Service Management processes, e.g. to record and track. OPAS tool will be used for the same.
Ticket (also referred as Incident)	This can be an Incident, Request for Information or Service request.
1st Line Support / Service Desk (SD)	The first level of support, which is responsible for receiving of all the tickets.
2nd Line Support	The second level of support, where the incident cannot be resolved by first-line support or requires time to be resolved.
3rd Line Support	The third level of support, where specialists' skills (e.g., development/engineer) or contracted third-party support is required.
Customer	The person from the business responsible for buying the Services (and endorsing the SLA)
User	The actual user of the Service.
Knowledge Base	A repository of information regarding Known Errors, Workarounds and Resolutions of incidents. In the absence of a separate database, the Incident Tracking System can be used as the Knowledge Base.
Known Error	A condition identified by the successful diagnosis of the root cause of a problem.
Problem	A condition identified as a result of multiple Incidents that exhibit common symptoms or as a result of a high impact

Table 3 Definitions and Descriptions

2.2.4.2 Roles and Responsibilities

This section describes the roles and responsibilities to be performed by the individuals participating in the Incident Management process.

Role	***Responsibilities***
Application Delivery Manager/Client Executive -	Responsible for the operation of application related services . Establishing agreements with the Accounts on service levels. Facilitate monthly reporting of cost model and service levels Acts as a point of escalation initiated either from the Account or from Infrastructure Solutions for issue resolution Facilitates Daily Operations Meeting
Service Manager	Responsible for all Service Management process-related training, reporting, development and implementation and overall process adherence for their accounts.
	Facilitates Daily Operations Meeting Responsible for account administrative set up on OPAS Service level reporting
Assignee	Respond in a timely fashion to notifications received – accept responsibility for Incident resolution, and provide periodic updates on progress made in compliance with Service Level specified timeframes. Analyze Incident and initiate corrective action to restore service within specified timeframes Completely and accurately document resolution activities Initiate reassignment of Incident records by fully documenting actions taken thus far and reason transfer of responsibility is necessary While retaining responsibility for Incident resolution, escalate to 3rd party support when needed – fully document actions taken by 3rd party support.
Assignee Group Manager	Accountable for their team's compliance with the Incident Management process Manage Assignee Group membership Manage Affected Items Ensure accurate, complete and timely updates for records assigned to their team

Service Desk Agent	Provide a single point of contact for client detected Incidents and status information Initiate manual notification and escalation of Incidents when necessary First Call Resolution
Process Management Team	Facilitate the Incident Management process Maintain documentation pertaining to the Incident Management process Coordinate all changes to OPAS as they relate to Incident Management
The Client/ End user	Provide accurate explanation of the disruption in service and respond to inquiries regarding the need for any additional information and overall satisfaction

Table 4 Roles and Responsibilities

2.3 OPAS

Objective: It is a tool where all the incidents are tracked with their date and time so keep a close eye on SLA.

IT organizations face many obstacles ensuring operations and costs are aligned with the needs of the organization. Perot Systems Service Management Services use proven methodologies, best practices, and proprietary management tools to provide IT organizations with a formalized management process to assess the effectiveness of their operations.

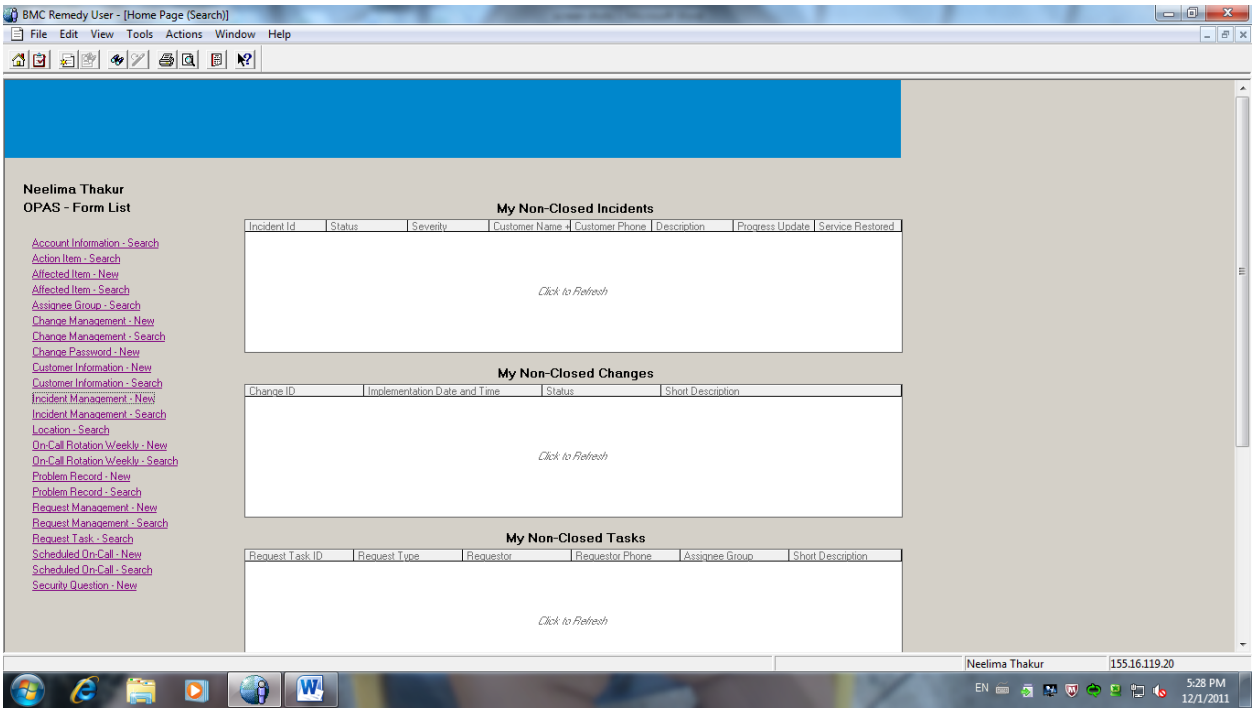


Figure 4. OPAS Explorer

OPAS (Operational Process Applications Suite) developed specifically to support service management processes for large and/or complex IT organizations, OPAS provides incident, problem, change, request, and configuration management across the spectrum of IT operational areas such as server support, operations, security and administration, network support, and disaster recovery.

Incident tickets reported in OPAS explorer are assigned in four groups. They are:

1. **MAX-HIS Application Support**
2. **Max-Application Parameters**
3. **Max-Mumps HL7 App Support**
4. **MAX-VistA Application Support**

- **MAX-HIS Application Support**: Incident tickets of request for user creation in Vista and HIS are raised in this group.

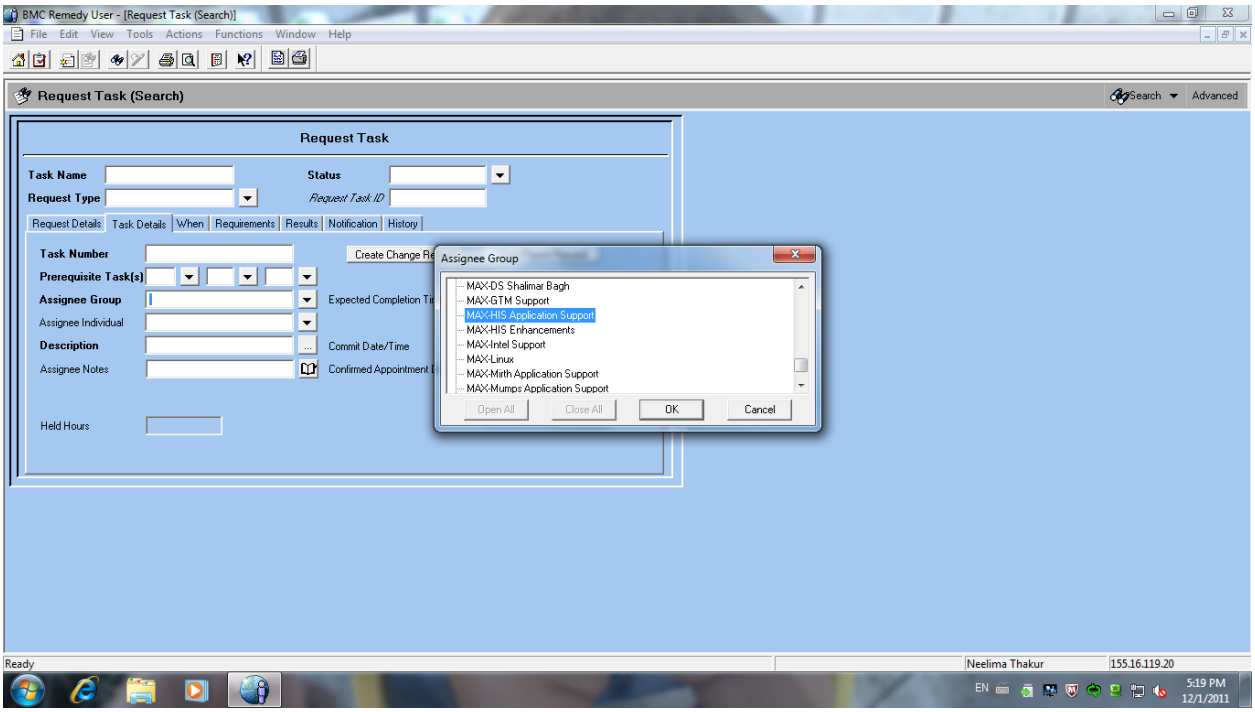


Figure 5. Max-HIS Application Support

- **Max-Application Parameters**: Incident tickets of request for user creation and for other rights and changes in HIS are raised in this group. HIS Issues and Privileges Issues are reported here.

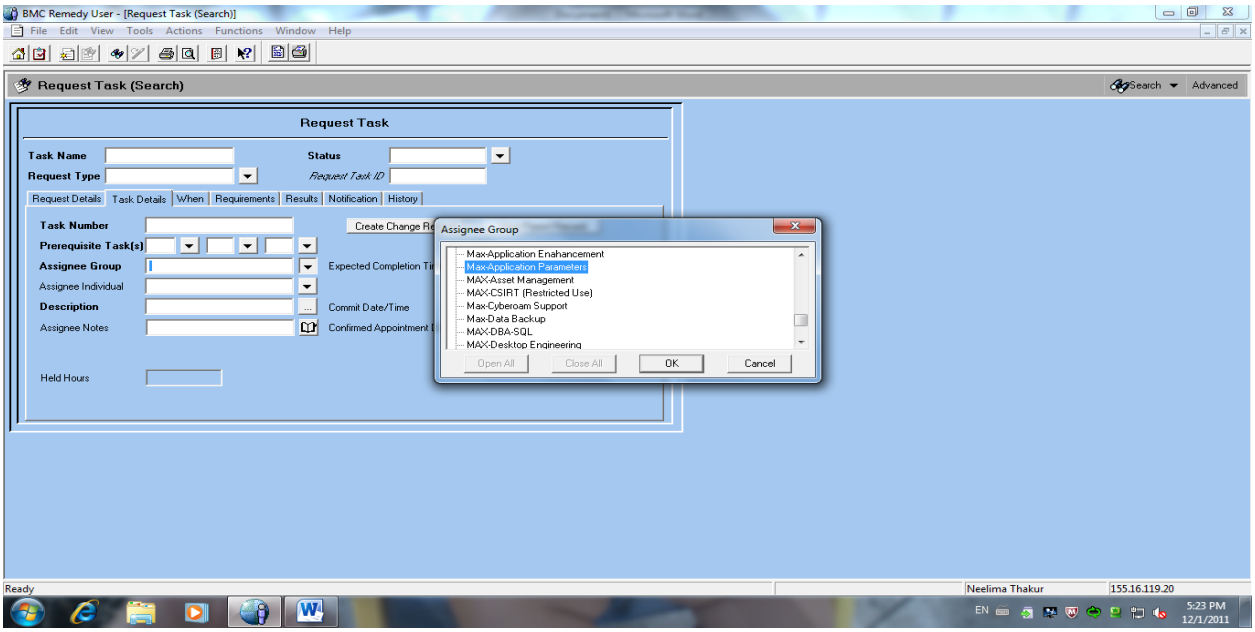


Figure 5 Max Application Parameters

- **Max-Mumps HL7 App Support:** Incidents tickets of integration issues related to HL7 and Mirth are reported in this group.

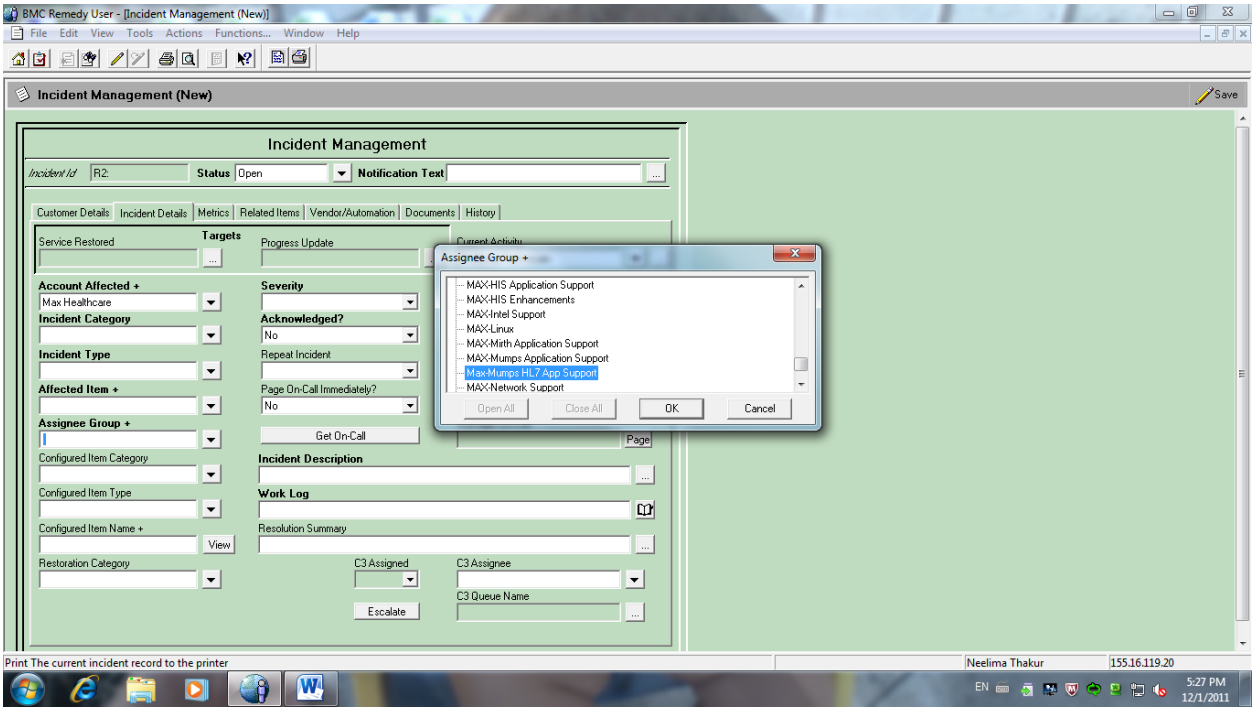


Figure 6 Max- Mumps HL7 Application Support

- **MAX-VistA Application Support:** Incident tickets of configuration issues, training issues and CPRS are reported in this group.

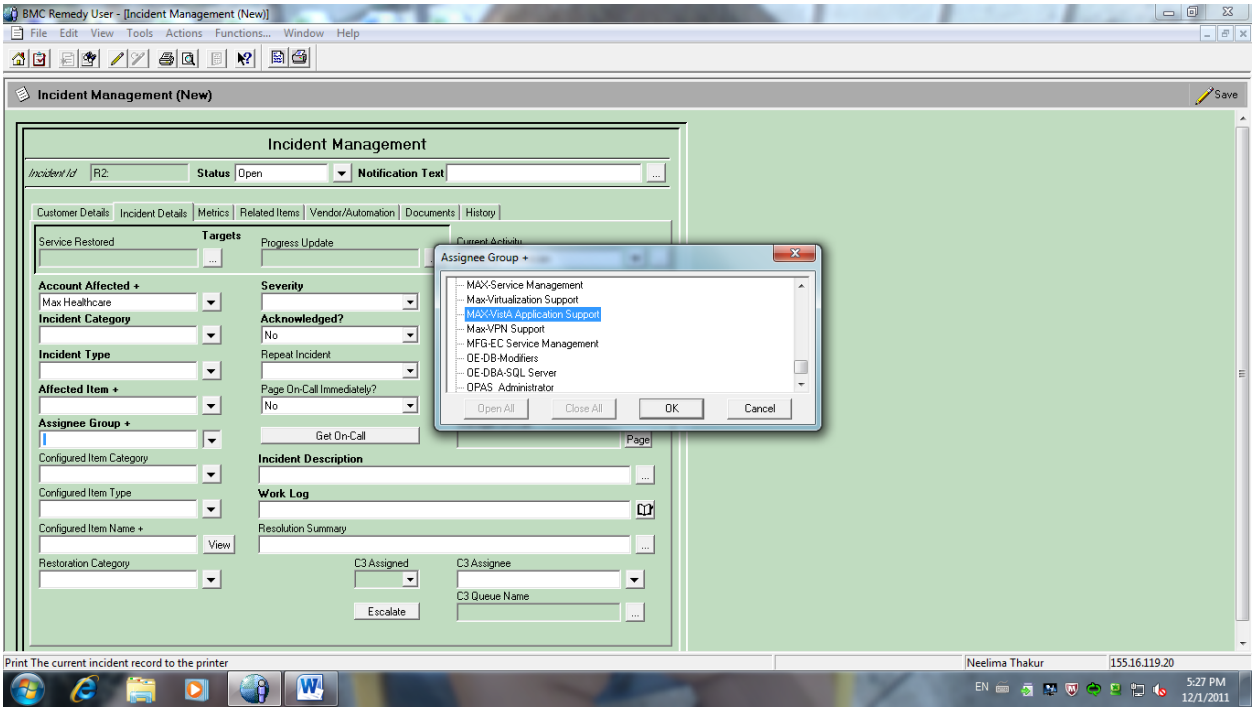


Figure 7 Max-VistA Application Support

2.3.1 BMC TOOL

BUSINESS CHALLENGE

IT Organizations are tasked with quickly creating and delivering service management applications that drive success. These applications must enable organizations to more effectively manage both infrastructure and service based interactions with customers and employees. They must be global in reach, highly scalable, and easily adapted to reflect the dynamic changes in your business. And they must leverage investments in legacy systems that orchestrate core functions and house-critical corporate data.

THE BMC SOLUTION

BMC Remedy AR System enables you to automate a broad range of business solutions, from service desk call tracking to inventory management to integrated systems management without learning a programming language or complex development tools. With its request-centric, forms-driven, workflow-based architecture, BMC Remedy AR System provides a comprehensive yet easy-to-use set of tools to continuously adapt and evolve your applications to the unique procedures and individual requirements of your company's user community. It enables IT administrators to quickly customize and extend out-of-the-box applications such as the BMC IT Service Management Suite without programming knowledge. It also acts as a single point of integration, including support for popular API types (such as Java and C), Web Services, ODBC, and utilities such as the BMC Atrium Integration Engine.

COST-EFFECTIVE PROCESS AUTOMATION ENVIRONMENT

BMC Remedy AR System provides a comprehensive solution for designing, developing, customizing, deploying, and automating service processes from a single environment. BMC Remedy AR System delivers more value — at a fraction of the cost of traditional process automation and deployment solutions. It offers a Web-optimized development environment, coupled with superior workflow and integration capabilities, to give your organization the ultimate flexibility in building powerful, accessible, easy-to-use, global applications. BMC Remedy AR System is a valuable partner to your company's program of continuous improvement and optimization of service delivery.

RAPID DESIGN AND DEPLOYMENT

Customers know that BMC Remedy AR System offers the fastest means to prototype, deploy, maintain, and iterate new service management applications. The BMC Remedy Developer Studio provides a modern and easy-to-use interface with simple point-and-click and drag-and-drop operations that allow developers and even non-technical business managers to quickly and easily build powerful business applications.

VISUALLY RICH, INTERACTIVE APPLICATIONS

Today's end users expect easy to use and visually rich applications. BMC Remedy AR System enables developers to quickly build compelling and highly interactive applications using out-of-the-box features:

» Multiple panel display types – tabbed, collapsible, splitter and accordion – to group related information

» Menus with auto-completion present a list of values that match the text being entered

» Visual effects display state transition and highlight focus

EASY INTEGRATION

Extensive integration facilities in BMC Remedy AR System enable you to build applications that leverage valuable corporate data from databases, legacy applications, scripting engines, and other data sources. Out-of-the-box integrations are available for the most commonly requested integrations for service management solutions, including network management systems (NMS), automated discovery, enterprise applications, and lightweight directory access protocol (LDAP) directories for seamless authentication and integration to centralized user directories. In addition, an extensive network of BMC Partners can provide pre-built and custom integration solutions that complement those available from BMC.You can share BMC Remedy AR System data and application structures with other systems using a variety of integration points, including a fully published API with XML, Java, and C interfaces available. You can also easily share data from external sources through BMC Remedy AR System Database Connectivity (ARDBC) and use the View Forms capability to expedite information access for users. As a result, you can eliminate time-consuming reentry of data and avoid the need to maintain duplicate data in multiple locations.

SUPPORT FOR WEB SERVICES

BMC Remedy AR System supports Web Services — a simple, platform-agnostic method for real-time, application to-application integration. Developers can publish a BMC Remedy AR System application or form as a Web Service for access anywhere in the enterprise. Developers can also subscribe to a private or public Web Service and link it to a form within a BMC Remedy AR System application to provide additional data or functionality to users. BMC Remedy AR System simplifies the implementation of this powerful integration technology for developers through a familiar drag-and-drop interface. In fact, when publishing or subscribing to a Web Service, no coding is necessary because BMC Remedy AR System automatically generates all communications — from the XML code to input parameters and messages.

SECURE, SCALABLE, GLOBAL DEPLOYMENT

In today's business environment, business applications must be global in scope and must offer secure, real-time, and localized access to corporate data for a large number of users running a variety of clients. Because BMC Remedy AR System supports multiple language views of the same application, translation into local languages requires only a single set of application logic to service users in multiple locations worldwide. This speeds development and simplifies maintenance of your applications.BMC Remedy AR System offers the configuration flexibility required to deliver global scalability. You can run multiple instances of BMC Remedy AR System on a single server, as well as run multiple BMC Remedy AR System servers with a single database. In addition, the BMC Remedy AR System Mid Tier works within Web farm/cluster and load balanced environments to ensure maximum performance under heavy user loads. BMC Remedy AR System supports Web browsers and native Windows clients, as well as wireless and handheld devices.

BMC Remedy AR System provides a variety of security access control features to protect sensitive applications and data. Password protection ensures that only authorized users are permitted to enter the system. Group permissions restrict authorized users to access only those system resources, such as applications, forms, fields, and even records, that they are authorized to view or change. BMC Remedy Encryption provides end-to-end encryption of data communication between all AR System components and is available in two versions that differ in key strength -128-bit and 2048-bit.

2.3.2 HL7

Health Level Seven (HL7) is a standard for electronic data exchange in all healthcare environments, with special emphasis on inpatient acute care facilities (i.e., hospitals). The term "Level 7" refers to the highest implementation protocol level for a definition of a networking framework as presented in the Open System Interconnection (OSI) model of the International Organization for Standardization (ISO). This is not to say that HL7 conforms to ISO defined elements of the OSI's seventh level. HL7 does, however, correspond to the conceptual definition of an application-to-application interface placed in the seventh layer of the OSI model. In the OSI conceptual model, the functions of both communications software and hardware are separated into seven layers, or levels. The HL7 Standard is primarily focused on the issues that occur within the seventh, or application, level. These are the definitions of the data to be exchanged, the timing of the exchanges, and the communication of certain application-specific errors between the applications. However, of necessity, protocols that refer to the lower layers of the OSI model are sometimes mentioned to help implementers understand the context of the Standard. They are also sometimes specified to assist implementers in establishing working HL7-based systems.

The HL7 Version 2.4 Standard currently addresses the interfaces among various healthcare IT systems that send or receive patient admissions/registration, discharge or transfer (ADT) data, queries, resource and patient scheduling, orders, results, clinical observations, billing, master file update information, medical records, scheduling, patient referral, patient care, clinical laboratory automation, application management and personnel management messages. HL7 Version 2.4 is designed (and used) to support a central patient care system as well as a more distributed environment where data resides in departmental systems.

Goals of HL7

HL7's purpose is to facilitate communication in healthcare settings. The **primary goal** is to provide standards for the exchange of data among healthcare computer applications that eliminate or substantially reduce the custom interface programming and program maintenance that may otherwise be required. This primary goal can be delineated as a set of goals:

a) The Standard should support exchanges among systems implemented in the widest variety of technical environments. Its implementation should be practical in a wide variety of programming languages and operating systems. It should also support communications in a wide variety of communications environments, ranging from a full, OSI-compliant, 7-level network "stack" to less complete environments including primitive point-to-point RS-232C interconnections and transfer of data by batch media such as tape, CD and USB Flash Drive.

b) Immediate transfer of single transactions should be supported along with file transfers of multiple transactions.

c) The greatest possible degree of standardization should be achieved, consistent with site variations in the usage and format of certain data elements. The Standard should accommodate necessary site-specific variations. This will include, at least, site-specific tables, code definitions and possibly site-specific message segments (i.e., HL7 Z-segments).

d) The Standard must support evolutionary growth as new requirements are recognized. This includes support of the process of introducing extensions and new releases into existing operational environments.

e) The Standard should be built upon the experience of existing production protocols and accepted industry-wide standard protocols. It should not, however, favor the proprietary interests of specific companies to the detriment of other users of the Standard. At the same time, HL7 seeks to preserve the unique attributes that an individual vendor can bring to the marketplace.

f) While it is both useful and pertinent to focus on information systems within hospitals, the long-term goal should be to define formats and protocols for computer applications in all healthcare environments.

g) The very nature of the diverse business processes that exist within the healthcare delivery system prevents the development of either a universal process or data model to support a definition of HL7's target environments. In addition, HL7 Version 2.4 does not make a priori assumptions about the architecture of healthcare information systems nor does it attempt to resolve architectural differences between healthcare

information systems. For at least these reasons, HL7 Version 2.4 cannot be a true "plug and play" interface standard. These differences at HL7 Version 2.4 sites will most likely require site negotiated agreements.

h) A primary interest of the HL7 Working Group has been to employ the Standard as soon as possible. Having achieved this, HL7 has also developed an infrastructure that supports a consensus balloting process and has been recognized by the American National Standards Institute (ANSI) as an Accredited Standards Organization (ASO).

i) Cooperation with other related healthcare standards efforts (e.g., ACR/NEMA DICOM, ASC X12, ASTM, IEEE/MEDIX, NCPDP, etc.) has become a priority activity of HL7. HL7 participates in the ANSI HITSP.

Message Framework

The Standard is written from the assumption that an event in the real world of healthcare creates the need for data to flow among systems. The real-world event that initiates an exchange of messages is called a **trigger event**.

For example, the trigger event **a patient is admitted** may cause the need for data about that patient to be sent to a number of other systems. The trigger event, **an observation (e.g., a CBC result) for a patient is available,** may cause the need for that observation to be sent to a number of other systems. When the transfer of information is initiated by the application system that deals with the triggering event, the transaction is termed an **unsolicited update**.

HL7 allows the use of trigger events at several different levels of data granularity and inter-relationships. For example, most Patient Administration (ADT) trigger events concern single objects (such as an admit event, which creates a message that contains data about a single person and/or account). Other ADT trigger events are concerned with relationships between more than one object (e.g., the merge events, which specify patient or account merges).

A **message** is the atomic unit of data transferred between systems. It is a unit of information, used for communicating between two or more EPA's.

Elements of an HL7 Message are as :

- Segments
- Fields
- Components
- Subcomponents

HL7 messages are ASCII messages and are defined sequence of segments and/or segment groups. Each segment, group, or message set within a message can be optional and/or repeating.

A **segment** is a logical grouping of data fields. Segments of a message may be required or optional. They may occur only once in a message or they may be allowed to repeat. Each segment is given a name. For example, the ADT message may contain the following segments: Message Header (MSH), Event Type (EVN), Patient ID (PID), and Patient Visit (PV1).

Each segment is identified by a unique three-character code known as the Segment ID. Each segment has its own semantic purpose. An HL7 message definition also states whether each segment is mandatory or not.

A field is a string of characters. Fields for use within HL7 segments are defined by HL7. Each field has its own unique purpose and is defined by the HL7 standard for each segment. A field may be either a primitive data type (string, number, etc.), or in turn be made up of **components and subcomponents**, which can be a primitive data type.

Each message has a **message type** that defines its purpose. For example the ADT Message type is used to transmit portions of a patient's Patient Administration (ADT) data from one system to another. A three-character code contained within each message identifies its type

Messages are a collection of segments. These segments need to occur in a specific sequence in the message. **Sequencing** can be defined as the process of sending the messages from source to destination in the same order as received from the source with possible omissions (skipping) in between. The sequence, optionality and

repeatability of these segments is defined in the HL7 specification for the given message type.

An HL7 message profile is an unambiguous specification of one or more standard HL7 messages that have been analyzed for a particular use case. It prescribes a set of precise constraints upon one or more standard HL7 messages.

HL7 does not care how systems actually store data within an application. When fields are transmitted, they are sent as character strings

An example of an HL7 message is –

MSH|^~\&|ADT1|MCM|LABADT|MCM|198808181126|SECURITY|ADT^A01|MSG00001|P|2.4|<cr>

EVN|A01|198808181123||<cr>

PID|1||PATID1234^5^M11^ADT1^MR^MCM~123456789^^^USSSA^SS||JONES^WILLIAM^A^III||196

10615|M||C|1200 N ELM STREET^^GREENSBORO^NC^27401-1020|GL|(919)379-1212|(919)271-3434||S||PATID12345001^2^M10^ADT1^AN^A|123456789|987654^NC|<cr>

NK1|1|JONES^BARBARA^K|WI^WIFE||||NK^NEXT OF KIN<cr>

PV1|1|I|2000^2012^01||||004777^LEBAUER^SIDNEY^J.|||SUR||||ADM|A0|<cr>

2.3.3 Purpose and the functioning of the integration engine – Mirth

An integration engine is software which moves data between information systems. This process involves the transformation of data between messaging standards and requires support for multiple transmission protocols.

Mirth Exchange is an initiative aimed at transforming healthcare delivery, quality, and safety by making high-value, standards-based interoperability solutions available to all stakeholders across the healthcare community on an open source basis.

Mirth Exchange is the industry's first repository of health information exchange interfaces and associated assets — documentation, sample messages, specifications, test harnesses, forums, issue tracking, and utilities — made available on a free and open source basis for community-driven development, testing, sharing, and refinement.

Mirth Exchange will fast-track healthcare interoperability by making common interfaces available for sharing and re-use, reducing time and cost barriers to interoperability. For example, an HIE can make available interfaces that they've invested in available to other HIEs and vice-versa. This will speed interoperability for all HIEs and, of course, other healthcare organizations. Hospitals, health systems, clinics and laboratories can do likewise.

Coupled with Mirth Connect, the leading open source interface engine, Mirth Exchange provides a platform for implementing and disseminating standards-based open source interoperability solutions. These solutions will help simplify the integration of legacy HIT systems, Meaningful Use platforms, and Health IT systems joining the NHIN.

"Mirth's ability to support multi-channel messaging modes, multi-protocol connectors, multiple languages for transformer scripting, and a full complement of end-point technologies make it an attractive interface engine for VistA-based solutions,"

This is an engine, which integrates the end applications by receiving and labelling the messages from the communication end-points. Communication end-points are the components, which handle communication between both source and destination end-

point applications and Integration Hub. They are responsible for initiating/receiving the communication request with the end-point applications. It also translates and routes these messages to the required destination end-point application with assured delivery. Routing is the process of moving message(s) from source to destination EPA, which qualifies the pre-defined rules.

2.4 Severities of Incidents

S.NO	Severity Name	Priority of Severity
1	Severity One	Highest
2	Severity Two	Medium High
3	Severity Three	Medium Low
4	Severity Four	Lowest

1. Severity One –

An Incident which severely impacts Customers business operations or renders it non-operational.

Examples include

- One or more site operations impacted
- Key services impacted (e.g. DNS)
- Key applications impacted (e.g. HIS, Vista, putty, Mirth e-mail)
- Key function impacted (e.g. Operation Theater, Front Desk, Admissions, Billing, Discharge)
- A majority of users in one location impacted
- HIS/Mirth/VistA not working for 1 or more facilities
- Email not working for all facilities
- Internet not working across Max
- Network down for 1 or more facilities for critical departments

Acknowledgement guidelines:

a. A notification is sent to the Primary Person On-Call immediately upon submission of an Incident record.

b. Primary Person On-Call is paged immediately after the creation of the record.

c. Secondary Person On-Call is paged if the Incident is not acknowledged and 5 minutes have passed since the Primary On-Call person has been paged.

d. The Manager On-Call will be paged after 10 minutes if the Incident is not acknowledged and both the Primary and Secondary persons On-Call have been paged

e. If the Incident is still not acknowledged after 30 minute, the Manager On-Call is continually paged at 15 minute intervals until the Incident is acknowledged, or the manager has been paged 7 times.

Customer Contact SLA:

This Severity Level is responded to on a 24x7 basis and shall have an acknowledgement target of 30 minutes.

Resolution SLA:

A Severity One Incident record is considered to be resolved on time if the Service is restored within four hours.

2. <u>Severity Two</u>

An Incident which materially impacts Customers business operations or degrades the capacity handing.

Examples include

Part of one site operations impacted

- Key services performance degraded
- Key application performance degraded
- HIS/VistA/Mirth working slow for 1 or more facilities'
- Primary VistA or Mirth server fails, secondary server working
- Internet not working for 1 or more facilities
- Sun not working for 1 or more facilities
- HIS/VistA not working for 1 floor or 1 department greater than 20 users
- HIS/VistA not working in several departments not listed as critical
- Multiple users (> 20) facing HIS timeout issues
- Primary HIS Server fails, Secondary server working
- More than 20 users impacted
- HIS Billing not working for entire facility
- Primary VistA or Mirth server fails, secondary server working
- Reported database is not working or connection timeout is reported
- More than 20 users impacted in one location.
- Critical business gets impacted causing delay in service to patient.

Acknowledgement guidelines:

a. A notification is sent to the Primary Person On-Call immediately upon submission of an Incident record.

b. Primary Person On-Call is paged immediately after the creation of the record

c. Secondary Person On-Call is paged if the Incident is not acknowledged and 15 minutes have passed since the Primary On-Call person has been paged.

d. The Manager On-Call will be paged after another 15 minutes if the Incident is not acknowledged and both the Primary and Secondary persons On-Call have been paged

e. If the Incident is still not acknowledged after 1 hour, the Manager On-Call is continually paged at 15- minute intervals until the Incident is acknowledged, or the manager has been paged 7 times.

Customer Contact SLA

This Severity Level is responded to on a 24x7 basis and shall have an acknowledgement target of 1 hour.

Resolution SLA

A Severity Two Incident record is considered to be resolved on time if Service is restored within 24 hours.

3. <u>Severity Three –</u>

An Incident which has minor impact on Customers business operations.

Examples include

- Up to 20 users impacted in one location
- Non-key services impacted (e.g. Wireless service)
- One or more Power user impacted.
- HIS/VistA not working for 1 or more departments (not listed as critical) less than 20 users
- Problem with multiple printers in same department or on same floor
- Incident logged for a VIP user
- HRIS, Sparsh, Gyan not working for 1 or more facilities
- ReportDB database is showing > 1 previous day data
- HIS Job has not worked
- Defect Reported in HIS/VistA

Acknowledgement guidelines:

a. In Business hours, a notification is sent to the Primary Person On-Call immediately upon submission of an Incident record.

b. In Business hours, primary Person On-Call is paged within 15 minutes of record creation

c. In Business hours, secondary Person On-Call will be paged if the Incident is not acknowledged and 30 minutes have passed since the Primary On-Call person has been paged.

d. In Business hours, manager On-Call will be paged after another 30 minutes if the Incident is not acknowledged.

e. In Business hours, if the Incident is still not acknowledged after 1 hour, the Manager On-Call is continually paged at 30-minute intervals until the Incident is acknowledged, or the manager has been paged 7 times.

f. Severity Three or Four Incidents opened during non-business hours will result in the Primary Person On-Call being notified at the beginning of the next business day, if the Incident record remains unacknowledged

Customer Contact SLA:

This Severity Level is responded to during the Customer's local business hours and shall have an acknowledgement target of 1 business day.

Resolution SLA:

A Severity Three Incident record is considered to be resolved on time if Service is restored within three business days.

4. **Severity Four –**

An incident which impacts only one user and does not disrupt business operations.

Examples include:

- Problem with 1 printer
- 1 User not able to access HIS/VistA
- Gyan Data to be refreshed
- Defect Reported in HIS

Acknowledgement guidelines:

a. In Business hours, a notification is sent to the Primary Person On-Call immediately upon submission of an Incident record.

b. In Business hours, primary Person On-Call is paged within 15 minutes of record creation

c. In Business hours, secondary Person On-Call will be paged if the Incident is not acknowledged and 30 minutes have passed since the Primary On-Call person has been paged.

d. In Business hours, manager On-Call will be paged after another 30 minutes if the Incident is not acknowledged.

e. In Business hours, if the Incident is still not acknowledged after 1 hour, the Manager On-Call is continually paged at 30-minute intervals until the Incident is acknowledged, or the manager has been paged 7 times.

f. Severity Three or Four Incidents opened during non-business hours will result in the Primary Person On-Call being notified at the beginning of the next business day, if the Incident record remains unacknowledged

Customer Contact SLA:

This Severity Level is responded to during the Customer's local business hours and shall have an acknowledgement target of 2 business days.

Resolution SLA:

A Severity Four Incident record is considered to be resolved on time if Service is restored within five business days

2.4.1 Incident Management Process

2.4.1.1 Entry Criteria

An incident that is reported by customer.

2.4.1.2 Inputs

- Tickets communicated to Service Desk by various modes such as
  - Phone Call,
  - Fax
  - E-Mail or
  - through Incident Tracking System
- Known Errors
- Resolution log of previously occurred incidents
- Additional configuration details from the CMDB or other supporting databases
- Auto generated incidents from HIS/Mirth/VistA error log
- Monitoring team can raise an incident if an abnormal system behavior is observed

2.4.1.3 Process Flow

1. End users contact the Service Desk when a service disruption is encountered.

2. The Service Desk initiates the incident management process by recording the service outage reported by the end user in OPAS via an incident ticket. If unable to restore service by performing initial triage steps, the Service Desk will assign the incident to appropriate support team. Triage steps will be documented during steady state.

3. The support team acknowledges incident tickets and contacts the end user for any details required to resolve the incident.

4. The support team works to restore service of the reported outage.

5. If the issue needs a code fix but the current incident service can be restored by providing data fix, the team provides the data fix. After confirmation with the user, the incident is closed and a problem ticket is opened to work on the permanent fix.

6. If the issue can't be resolved by any kind of data fix and a code fix is needed to rectify the issue, a problem ticket is opened for the issue. The same is communicated to the user as well.

7. In case if support team realizes that the outage is on the infrastructure side, the incident ticket is reassigned to other support groups as necessary. Support associates reassigning incident tickets will contact the new assignee via telephone to inform the reason for the reassignment and work that has been done thus far. The support team will also document all efforts to resolve the incident in the work log field of the incident ticket. This process continues until service is restored.

8. In case if the application involved in outage is vendor supported i.e. no support group exists in OPAS for application support, the support associate will need to contact the vendor as per vendor contact information. In case if the vendor is not available, the support associate will leave a voice mail and put incident in Suspend status till he hears back from Vendor.

9. Severity levels will be assigned to all incident tickets.

10. The support team updates the status of an incident to reflect the current state of the incident in its progression to service restoration.

11. The support team updates the work log field with all communications and efforts made to restore service and when the status of the incident changes.

12. At the end of the shift, Primary On-call would fill the Handover Takeover from as per the checklist This checklist would contain the Suspend incidents' details and also any other issues which the Primary of the next shift needs to take care of. This handover form would act as an input to next shift.

13. In case of server related issues the support team will try end follow the server escalation route and then install application from backup.

14. Incident Closure: Support team associates contact end users on every resolved incident prior to placing the ticket in "Service Restored" or "Closed" status. The preferred method of contact is in person (Face-to-Face) or telephone.

a. Only for severity three or four incidents requiring end user participation to resolve the issue, support associates will make three reasonable attempts to contact the end user for their assistance within the applicable SLA severity timeframe. Each attempt is fully documented within the incident work log. The support associate should add read/receipt on the email in order to verify that the customer has read the mail. It will also be acceptable to receive validation that the incident is resolved from a coworker of the customer. If the end user is unreachable, the support associate will document that fact in the incident work log and place the ticket in "Suspend" status prior to exceeding the applicable SLA resolution requirement.

b. Severity one & two incidents will be worked through complete resolution of the issue. The support associate shall monitor Severity one & two incidents in Suspend status and escalate issues as required.

15. Daily Morning Operations Review - The Morning Operations Review meeting is the forum where all severity one and two incidents are evaluated for resolution, permanent solution, appropriate severity and compliance with the incident management process.

16. Validation - Validation is done with reporting produced by the Service Management associates to verify compliance with Service Level Agreements.

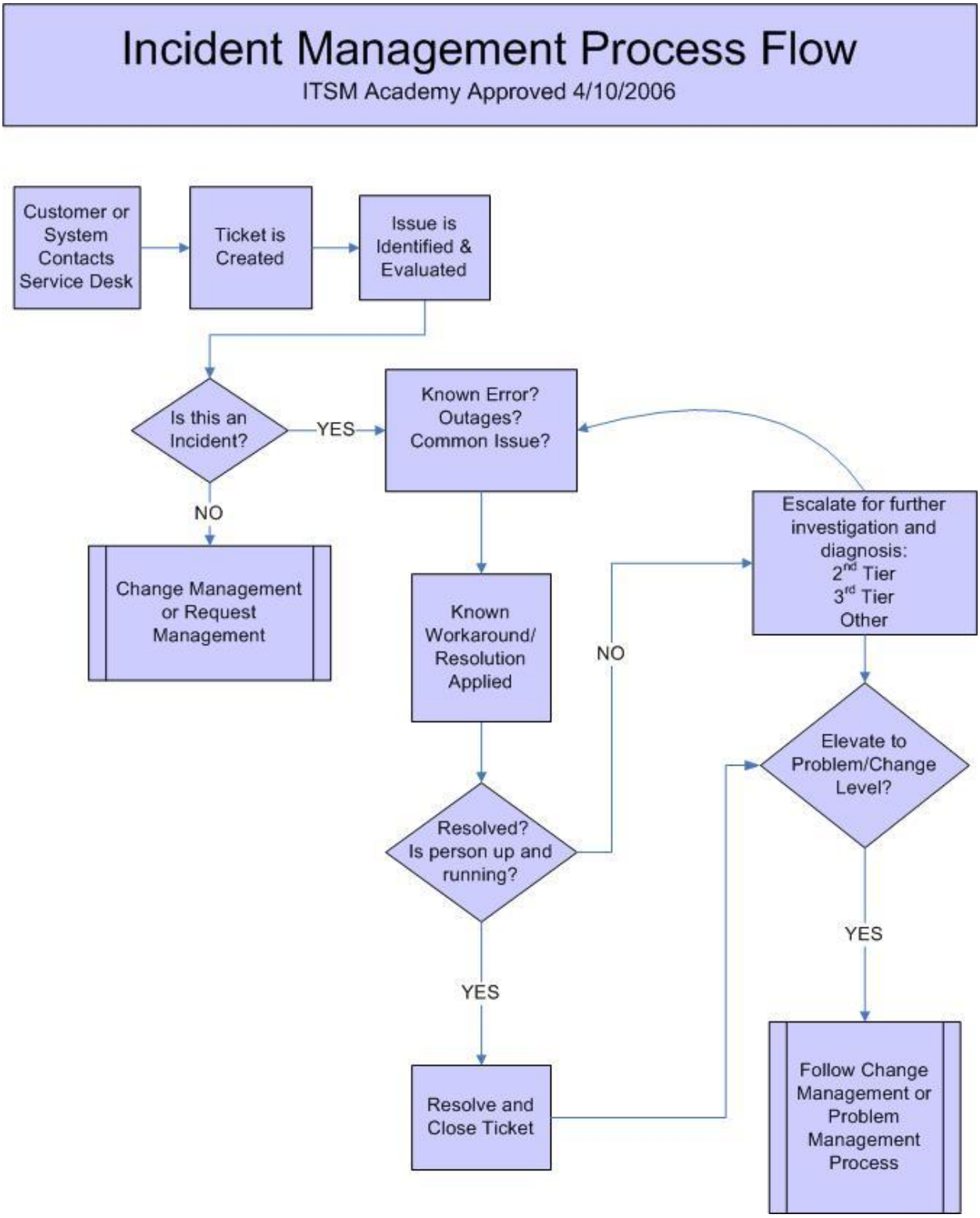


Figure 8 Incident Management Flow Chart

2.4.1.4 Exit Criteria

- Support team associates contact end users for verification, on every resolved incident prior to placing the ticket in “Service Restored” or “Closed” status. The preferred method of contact is in person (face-to-face) or telephone. E-mail and voice mail are also acceptable

2.4.1.5 Incident Life Cycle

Status	Definition	SLA Clock
Open	Initial status of all incidents – indicates assignment has not been accepted. Re-assigned incidents are set to Open status	Starts Running
Assigned	Problem assignment has been accepted and trouble-shooting is underway.	Running
Hold	Service not restored – waiting on something, but we are still responsible to meet the Targets. Example: record is escalated to a Perot Systems vendor, and we are still responsible for meeting the Targets	Running
Suspend	Service not restored. Two examples of the appropriate use of this status: 1. A major outage has been attributed to a vendor; the vendor is working on the issue, and we are no longer the responsible party for the outage. (*Third Party*) 2. A customer reports an incident, and the Assignee is attempting to restore service. The Assignee calls the customer to confirm restoration of service, but the customer's voicemail indicates he is on vacation for a week. (*Customer Unavailable*)	Paused
Monitor	Service has been restored although reliability of the solution is in question.	Running
Service Restored	Service has been restored or an acceptable work around has been implemented.	Stopped
Closed	The client has approved the resolution and the reported problem no longer exists.	Stopped

Table 5 Incident Life Cycle

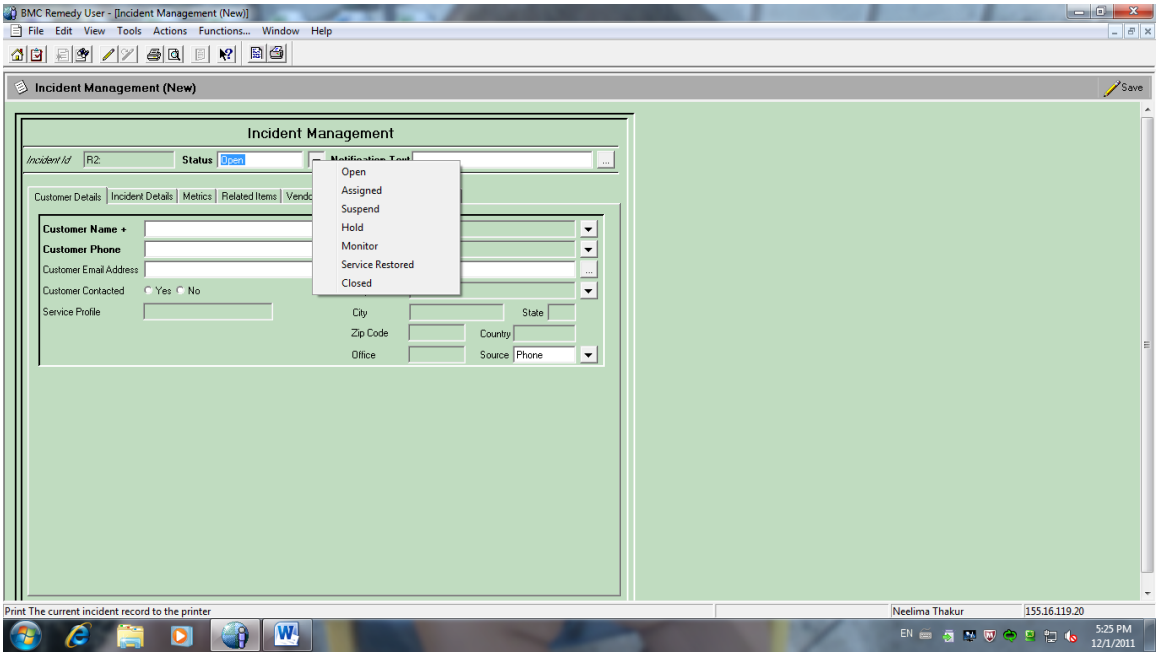


Figure 9 Incident Life Cycle

The Suspend Status may be used to stop the SLA clock for the following five specific reasons:

1. The restoration of service is dependent upon making a change that may not be implemented prior to the next scheduled maintenance window (Awaiting Change)

2. The restoration of service requires action from the customer (Awaiting Customer Action)

3. The restoration of service is dependent upon the transport of a device, such as a replacement part (Awaiting Transport of Device)

4. There is a clear indication that the customer is not going to respond for a specific length of time (Customer Unavailable)

5. The reported outage can be attributed legitimately to a responsible vendor (Third Party).

   At the end of each day a list of all suspended tickets to be circulated with the name of person or company responsible for action to close the ticket.

2.4.1.6 Status Matrix

Below table indicates what transitions are allowed from what status in the incident.

		To Status						
		Open	Assigned	Hold	Suspend	Monitor	Service Restored	Closed
From Status	New Entry	Yes	Yes	Yes		Yes	Yes	Yes
	Open		Yes	Yes		Yes	Yes	Yes
	Assigned	Yes		Yes	Yes	Yes	Yes	Yes
	Hold		Yes			Yes	Yes	Yes
	Suspend		Yes					
	Monitor		Yes	Yes			Yes	Yes
	Service Restored							Yes
	Closed							

Table 6 Status Matrix

2.5 Observations

Incident Record was taken for the period of 12 Sept to 25 Sept and for 25 Oct to 1 Nov. It was found that following issues were reported during observation:

1. **Configuration Issue**: Data entry errors. E.g. user name is not showing in doctors list in CPRS.
2. **Data Mapping**: It is the process of creating data element mappings between two distinct data models. These issues were raised because of wrong data mapping. E.g. Investigation ordered in CPRS is not reflecting in HIS.
3. **HIS Defect**: This issue developed because of integration problem as message flow from HIS to CPRS did not happen properly. E.g. Patient transfer is not visible in CPRS.
4. **Training Issues**: This issue is develops as End user does know to properly use the CPRS and HIS.
5. **Vista Issues**: This is vista software bugs.
6. **Temporary Issue:** This issue develops when there is problem with Infrastructure Support or with network.
7. **Privilege Issue:** This issue develops when Application Maintenance and Support team had not given proper rights to user. E.g. User did not get the required the rights in HIS, unable to create purchase order in HIS.

Classification of Incidents on the basis of Issues for the period of 12-25 Sept

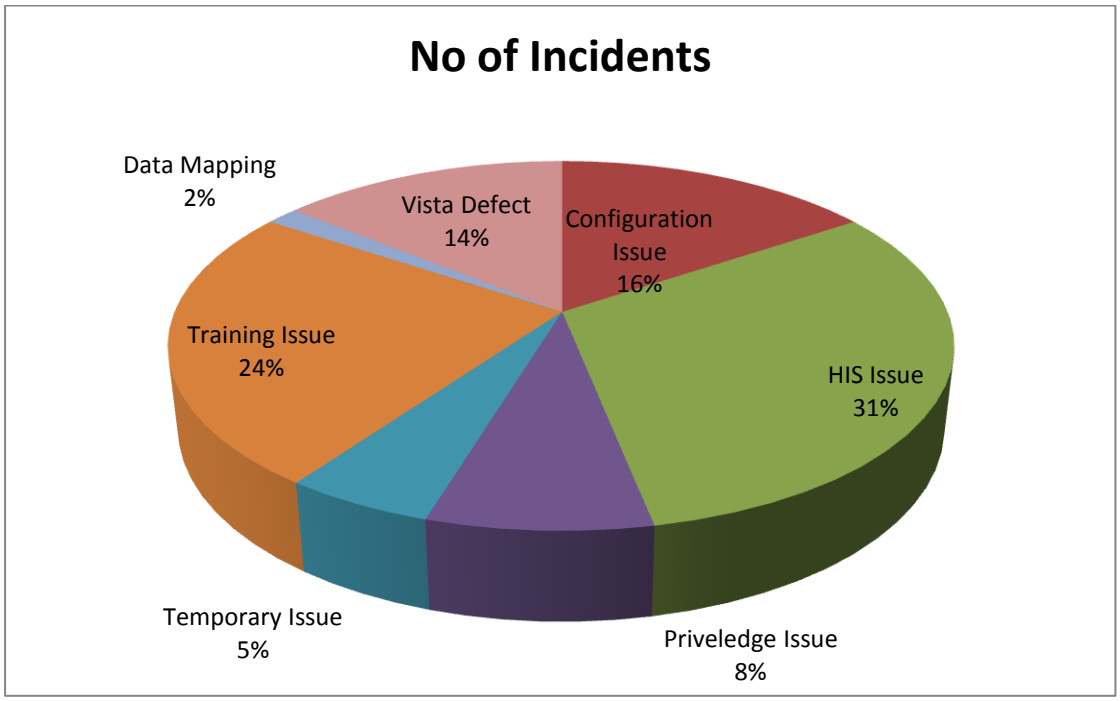


Figure 10 Incident Record of 12-25 Sept, 2011

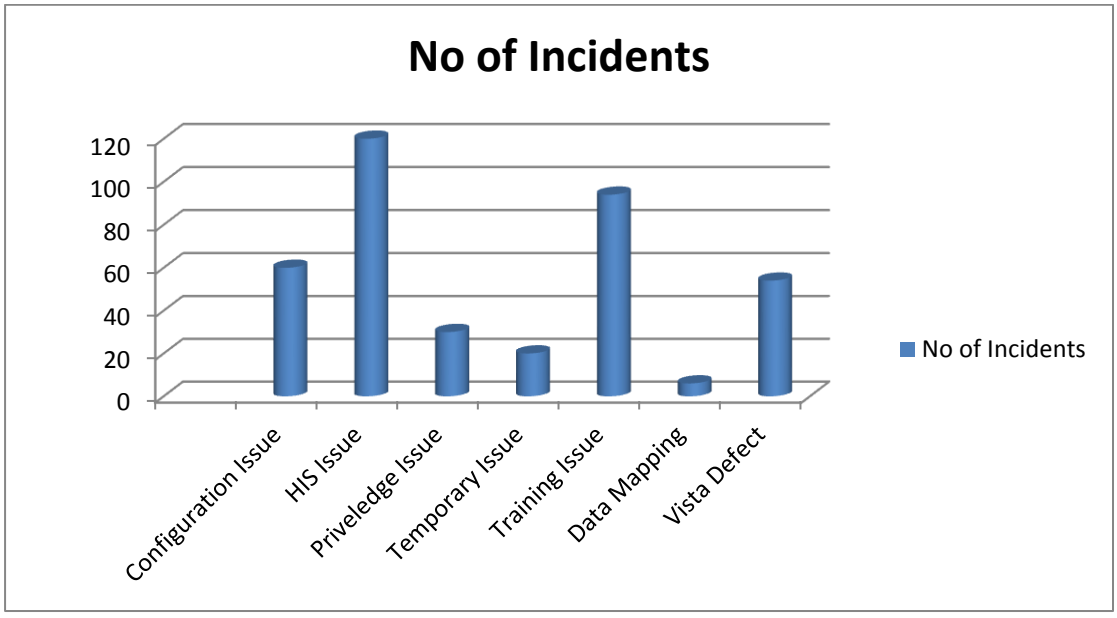


Figure 11 Incident Record of 12-25 Sept, 2011

From the data collected and analysis done for the month of September, 2011 it was observed that maximum numbers of incidents are because of HIS Defect and minimum number of incidents are of Data Mapping.

Classification of Incidents on the basis of Issues for the period of 25 Oct- 1 Nov 2011

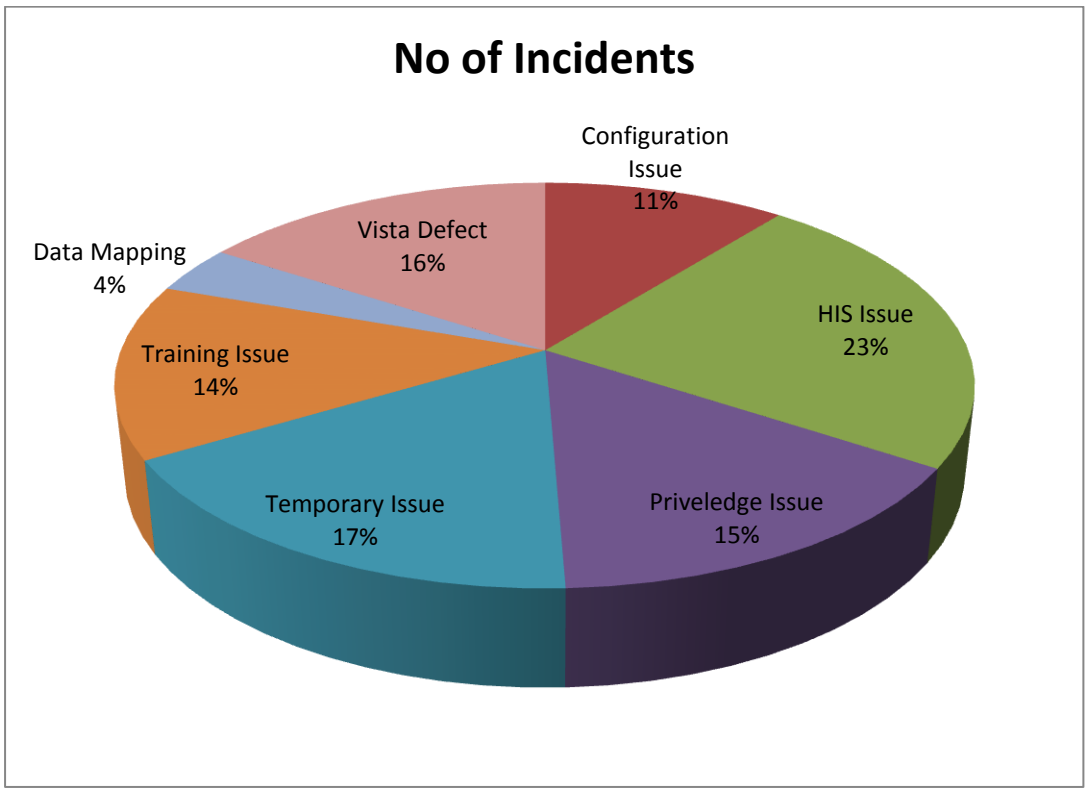


Figure 12 Incident Record of 25Oct-1 Nov, 2011

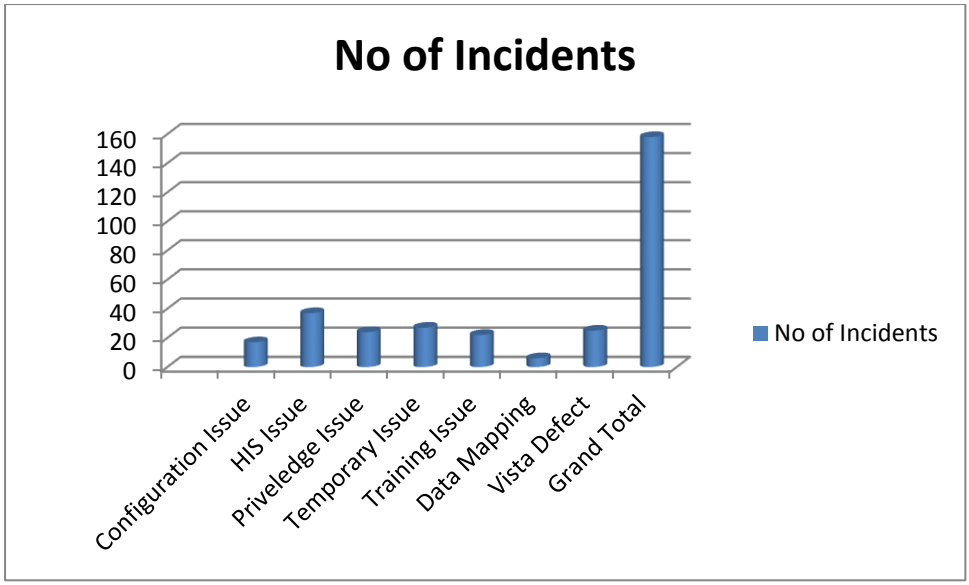


Figure 13 Incident Record of 25Oct-1 Nov, 2011

From the data collected and analysis done for the month of October, 2011 it was observed that maximum numbers of incidents are because of HIS Defect and minimum number of incidents are of Data Mapping.

Classification of Incidents on the basis of assignee groups for the period of 12-25 Sept, 2011

Incidents are also classified on the basis of assignee group where incident tickets were raised.

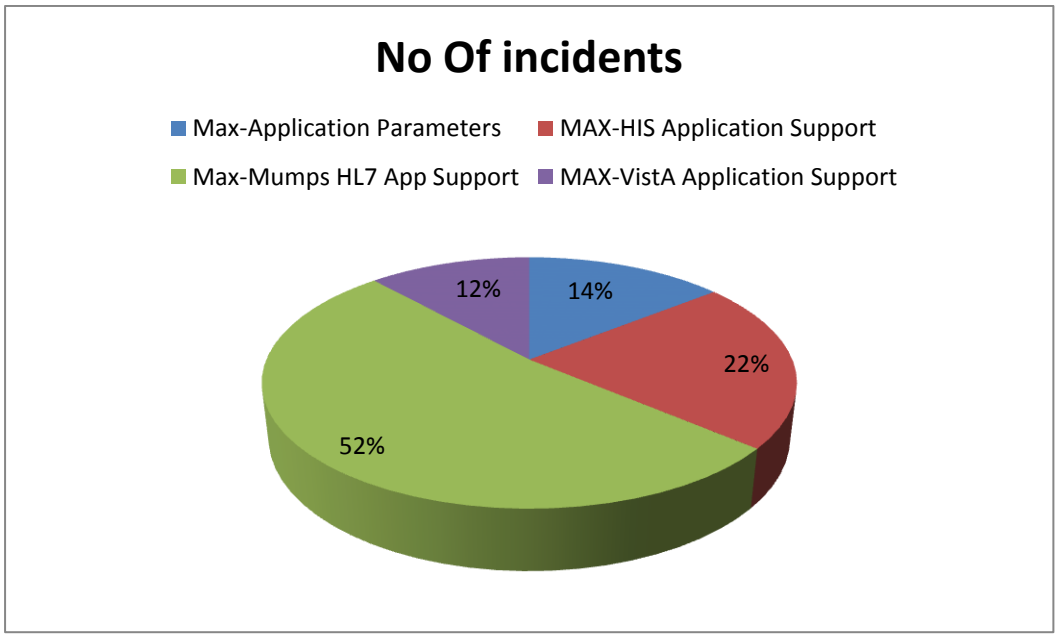


Figure 14 Incident Record of Assignee Groups

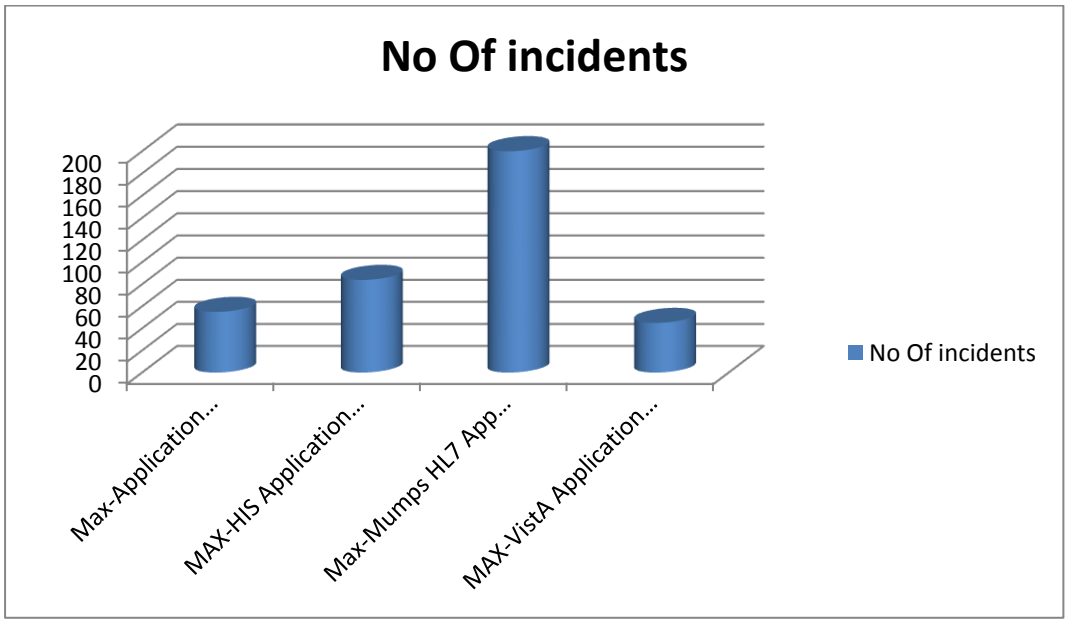


Figure 15 Incident Record of Assignee group

Classification of Incidents on the basis of assignee groups for the period of 25Oct-1 Nov, 2011

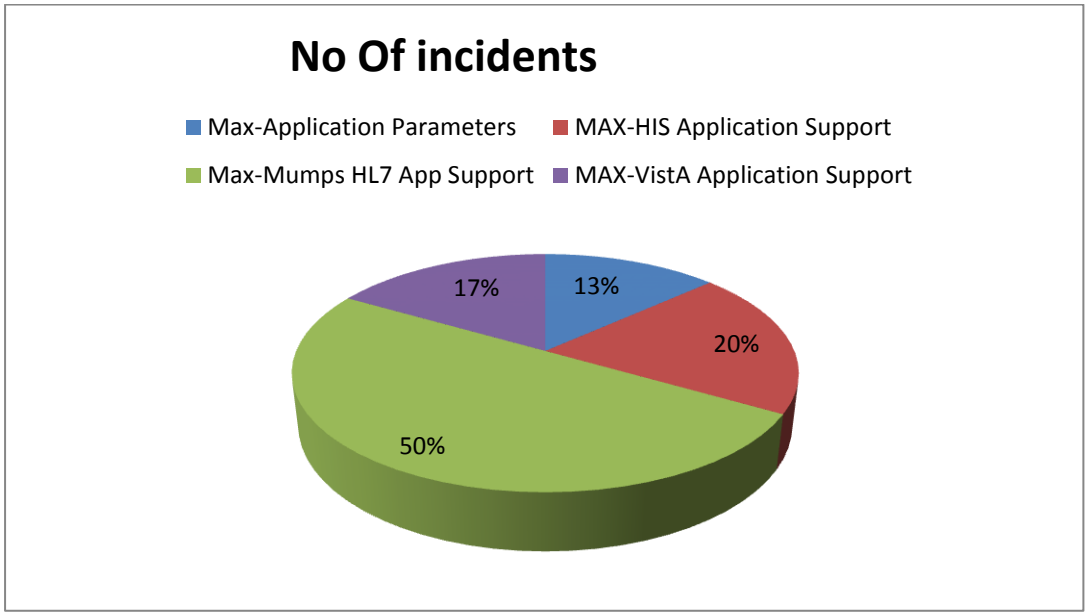


Figure 16 Incident Record of Assignee Groups

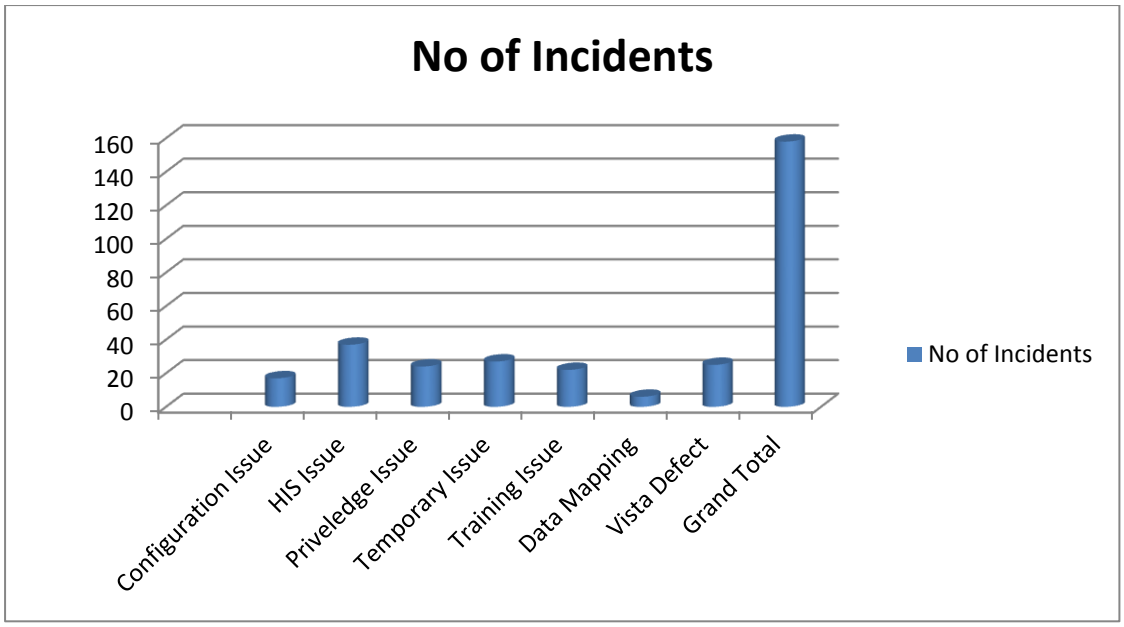


Figure 17 Incident Record of Assignee Groups

From the data collected it was observed that maximum numbers of incident tickets were raised in MAX-Mumps HL7 Application Support and minimum in Max-Application Parameters Group.

2.6 Result

The maximum number of incidents develops because of integration problem as both HIS and VistA are two diverse software's and the HL7 incompatibility of HIS makes it difficult to integrate it with VistA.

There are two options to solve an Incident:

- **Without a code change**: The associate can solve the incident, through analysis depending on the Business/Functional Knowledge and the Process Flow of various applications involved in carrying out the processes. E.g parameter changes.

- **With a code change:** This has to be done via the Change Management Procedures.

2.7 Conclusion`

From above observations it was found that maximum incidents are of HIS defects and minimum numbers are of Data mapping. As it was already mentioned that VistA was implemented in the Hospital that was integrated with the existing Hospital HIS to provide advanced clinical functionality which is limited in the current HIS. These two different systems, HIS and VistA, were integrated by means of an Integration Engine. After the \implementation of VistA and its integration with HIS the system will be working as the patient information will be easily passing from one system to the other through the integration engine – Mirth.

As HIS and VistA are two diverse software's, there are many problems identified in their integration process and this leads to development of maximum no of incidents because of HIS defect. Because of this integration issue max no of incident tickets raised in MAX Mumps- HL7 Application Support group.

The reasons for these incidents are:

Reason for HIS Defect and VistA Defect are:

- The HL7 incompatibility of HIS makes it difficult to integrate it with VistA. As Health Level Seven (HL7) is a standard for electronic data exchange in all healthcare environments. It addresses the interfaces among various healthcare IT systems that send or receive patient admissions/registration, discharge or transfer (ADT) data, queries, resource and patient scheduling, orders, results, clinical observations, billing, master file update information, medical records, scheduling, patient referral, patient care, clinical laboratory automation, application management and personnel management messages. VistA is a product which is completely compatible with HIS. But as HIS is not compatible with HL7 this leads to development of incidents.

  HL7 message format requires some mandatory fields to be included which may be mandatory or optional in the case of HIS. So, to match the fields and convey the HIS message, the fields have to be matched properly and similarly in both the systems.
- VistA is the system, basically developed by the Veterans in United States, so it was developed keeping the Veterans into consideration which is different from an Indian scenario. Whereas HIS is based on the Indian Hospital which is typically for the Indian patient's perspective. Hence many aspects which are important and required for Veterans are not at all required for Indians.

  For example, SSN which is a Social Security Number in United States and is being given to every individual is recorded in the system in Patient details. But in India there is no such number allotted to individuals. In this case, it is a challenge to map the field for SSN in HIS. Then, the data type in the field of SSN is fixed as a nine digit number which is also different from the Hospital's outpatient and inpatient number. So, matching the VistA's SSN field is to be matched to the HIS's outpatient number field.

So, the legacy HIS is an in-house product modified as per the day to day processes of the Hospital whereas VistA is a standard product which is not easily modifiable as per the Indian processes making it difficult to integrate with HIS.

Reasons for Training Issues:

- As new staff join hospital frequently, so they are new to system and they commit quite a few mistakes and gradually get proficient and thus during this period issues are developed.
- More over Doctors/Nurses are not so computer savvy and so they are reluctant to use the system and also commit a lot of mistakes.

Reasons for Privilege Issues:

- When all the rights required by the users is not given by the Support Team because users does not fill all the rights required by them in SAR form ,than this type of issues were developed.
- Also there is frequent shifting of nurses and other staff in different wards and floors that there is a need for quick update of the data which is not followed at present.

Reasons for Configuration Issues:

- The changing requirements from the client side leads to this issues and also to configure the health-org structure for a network of hospitals in the system with complex business rules is a challenging task.[12]

Reasons for Temporary Issues:

- These issues develop because of technical problem or when the server is down.

Reasons for Data Mapping Issues:

- VistA has been developed according to the US veteran servicemen and hence its functionalities, data-elements and attributes are different from that of Indian healthcare, so it is a challenge to implement it in the Indian healthcare scenario. Some examples are:

a) **Example 1. Pin code :**
   VistA: Pin code is a 4 digit field.
   Indian scenario: Pin code is of 6 digits
b) **Example2.Date:**
   VistA: Date format is mm/yy/dd.
   Indian scenario: The date format is dd/mm/yy

- The way data is stored in both the systems is very different. For example the Patient's name in HIS is stored in parts like first, middle and last name whereas in VistA it is as one name.
- In HIS there are different types of patients like Outpatients, Inpatient, emergency and pre-ADT where as in VistA there are only two types of patients that is Outpatient and Inpatient.

2.8 Recommendations

To minimize the number **of incide**nts following recommendations should be followed:

- Software should be upgraded and made HL7 Compatible, so it will easy to enable the interoperability.
- Every configuration should be cross checked and reviewed.
- Time to time training should be given to new staff, refreshers and end users.
- Hardware and network maintenance: Computers, peripherals, printers, routers and cables are bound to stop working from time to time have to be attended to right away and in house staff should be available to attend these issues.
- Bug reporting and fixing: The hospital should have a bug reporting form that is available at each workplace within the establishment. This form should be completed every time any user encounters any big in the software. An attempt should be made to educate users to distinguish between hardware, networking and software faults.
- Complete requirements should be taken from the client side and they should be documented and fixed before working on them.

It is beneficial for organizations to evaluate that they are meeting their missions and conducting their operations in an effective and efficient manner. Any evaluation criteria or mechanism should be done with management approval and collaboration.

Evaluations can be performed for a variety of reasons to meet different criteria including:

- Incident handling satisfaction
- Incident response timeliness
- Damage from an incident
- Process workflow
- General mission success

Organizations can choose different measures including:

- Benchmarking against other organizations or established standards
- Interviews and discussions with constituency representatives
- Evaluation surveys
- Audits or third-party evaluations based on predefined quality parameters

The CERT CSIRT Development Team has two methods that organizations can use to evaluate and improve their capability for managing incidents.

Incident Management Capability Metrics (IMCM)

The Incident Management Capability Metrics provide organizations with a baseline against which they can benchmark their current incident management processes or services.

The goal of this incident management capability evaluation is to help organizations assemble the right set of people, processes, and technology that enables them to protect and sustain their critical data, assets, and systems, and to conduct appropriate response and coordination actions for handling events and incidents when they occur.

These metrics can be used to

- Evaluate an existing capability
- Identify areas for process improvement in an existing capability
- Help determine the services and functions needed to create an incident management capability

The results obtained from the IMCM help an organization determine the maturity of its incident management capability regardless of organization or sector type (commercial, academic, government, etc.).

Incident Management Mission Diagnostic (IMMD)

The Incident Management Mission Diagnostic Method is a risk-based approach for determining the potential for success of an organization's incident management capability.

This potential for success is based on a finite set of key indicators used to estimate the current incident management capability health relative to a defined benchmark. Decision-makers can determine if the current state of their capability is acceptable, or if actions are required to improve the situation. The IMMD can be viewed as an efficient, first-pass screening of the capability to provide a quick evaluation and diagnose any unusual circumstances that might affect its potential for success.

2.9 References

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2.10 Annexure

2.10.1 Incident Analysis of 12-25 Sept

Incident Analysis_Sep12-25.xl

2.10.2 Incident Analysis of 25 Oct- 1 Nov

Incident Analysis_Oct 25 to N