DISSERTATION

AT

DELOITTE, BENGALURU
(FEB 09 – MAY 13, 2015)

Analysis of Issues in the Outpatient Setup, Post Implementation of an Electronic Health Record System

By

Himanshu Khetarpal

PG/13/027

Under The Guidance

Dr. Anandhi Ramachandran

Associate Professor

Post Graduate Diploma in Hospital and Health Management

2013-2015

International Institute of Health Management Research

New Delhi

Deloitte

Deloitte Consulting
India Pvt. Ltd.
Block "C",
Divyasree Technopolis
Survey No: 123 & 132/2
Yemlur Post,
Yemlur – Old Airport Road
Bengaluru Karnataka,
Pin Code – 560037, India

Tel: +91 80 6755 5000
Fax: +91 80 6755 3000
www.deloitte.com

May 13, 2015

To Whom It May Concern

This is to certify that Mr. **Himanshu Khetarpal** was on a fixed term Internship from **February 09, 2015** to **May 13, 2015**. He has successfully completed his Internship in **Application Management Services**.

We wish you the very best in your future endeavors.

Yours truly,

For Deloitte Consulting India Pvt. Ltd.

GUNJAN MITTAL

Digitally signed by GUNJAN MITTAL
DN: c=IN, o=Personal, ou=CID - 2677500, postalCode=500019, st=Andhra Pradesh, serialNumber=6e5ec5e5b1437ab53 8c76bd3dda78f0b456ecc3b562d2f7 5d30e6b19b097e63d, cn=GUNJAN MITTAL
Date: 2015.05.13 12:44:00 +05'30'

Authorized Signatory

TO WHOMSOEVER MAY CONCERN

This is to certify that Himanshu Khetarpal, student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from International Institute of Health Management Research, New Delhi has undergone internship training at Deloitte Consulting, Bengaluru from February 09, 2015 to May 13, 2015

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his future endeavors.

Dean, Academics and Student Affairs
IIHMR, New Delhi

Professor
IIHMR, New Delhi

Certificate of Approval

The following dissertation titled **"Analysis of Issues in the Outpatient Setup, Post Implementation of an Electronic Health Record System"** 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
Dr. Oommen John	
Dr. Anandhi Ramachandran	

Certificate from Dissertation Advisory Committee

This is to certify that **Himanshu Khetarpal** a graduate student of the **Post- Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. He is submitting this dissertation titled "**Analysis of Issues in the Outpatient Setup, Post Implementation of an Electronic Health Record System**" 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.

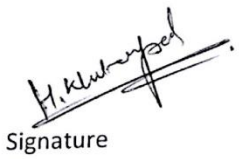
Dr. Anandhi Ramachandran,
Assosciate Professor,
IIHMR, New Delhi

Siddharth Biswas
Team Lead
Deloitte U.S India Consulting

INTERNATION INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled Analysis of Issues in the Outpatient Setup, Post Implementation of an Electronic Health Record System and submitted by Himanshu Khetarpal Enrollment No. PG/13/027 under the supervision of Dr. Anandhi Ramachandran for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from February 09, 2015 to May 13, 2015 Embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.



Signature

FEEDBACK FORM

Name of the Student: HIMANSHU KHETARPAL

Dissertation Organization: DELOITTE CONSULTING

Area of Dissertation: APPLICATION MANAGEMENT SERVICES

Attendance: 100%

Objectives achieved:
Explained the role of IT in OutPatient Clinics
Analysis of trend occurring in the Break Fixes and Requests Raised by Providers
Clear Demonstration of Ambulatory Workflows

Deliverables:
Presentation on the issues in Clinics post IT implementation
Good understanding of IT in OutPatient setup

Strengths:
Good Team Player
Pays attention to details
Good Communication Skills – both verbal and written
Has good understanding of Healthcare setup

Suggestions for Improvement: Aim to develop an expertise on US Healthcare setup and terminologies

Biswas (SIDDHARTH BISWAS)

Signature of the Officer-in-Charge/ Organization Mentor (Dissertation)

Date: 13th May 2015
Place: Bangalore

ABSTRACT

The Outpatient Electronic Health Record (EHR) System is an electronic server-based application designed with high flexibility and ease of usage, implemented in hospitals, single clinics and polyclinics. It is a complete outpatient management system that handles all the business functions from patient management, diagnosis, prescribing medications & orders to reporting.

This study analyses the commonly occurring challenges when the EHR is deployed across clinics. 200 issues were gathered from Incident Management Tool and a Root Cause Analysis was done. Identified issues were categorized into 4 major heads i.e. User Training Issues, Incorrect Build, System/ Network Issues and Third Party Vendor Issues. The changes in trend of issues from year 2014 to 2015 were analyzed and the recommendations were provided to reduce the recurrence of the similar types of issues.

ACKNOWLEDGMENT

Hard work, guidance and perseverance are the pre requisite for achieving success. Support from an enlightening source helps us to proceed on the path. I wish to thank first of all the almighty that provided me energy for the successful completion of dissertation report at Deloitte, Bengaluru.

I am thankful and obliged to my mentor at Deloitte, Bengaluru Mr. Siddharth Biswas for giving me an opportunity to work on this report and for his continuous support, guidance and perseverance during the course of my report generation.

I am highly indebted to my mentor at IIHMR, New Delhi Dr. Anandhi Ramachandran for her valuable guidance and motivation on various aspects of report.

It has been my good fortune to be benefited by their knowledge, guidance and deep insight without which this report would not have taken the exact shape .To them, I tender my heartfelt regards

TABLE OF CONTENTS

Part 1- Internship Report

Part 2- Dissertation Report

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

EHR	Electronic Health Record
EMR	Electronic Medical Record
HITECH	Health Information Technology for Economic and Clinical Health
PHI	Protected Health Information
ARRA	American Recovery and Reinvestment Act
CDS	Clinical Decision Support
CPOE	Computerized Physician Order Entry
HIE	Health Information Exchange
PCH	Primary Care Hospital

Part 1- Internship Report

ORGANIZATION PROFILE

Deloitte provides industry-leading audit, consulting, tax, and advisory services to many of the world's most admired brands, including 70% of the Fortune 500. Deloitte functions across more than 20 industry sectors with one purpose: to deliver measurable, lasting results. Deloitte helps reinforce public trust in our capital markets, inspire clients to make their most challenging business decisions with confidence, and help lead the way toward a stronger economy and a healthy society. Deloitte has more than 210,000 professionals at member firms delivering services in more than 150 countries and territories. Revenues for fiscal year 2014 were US$34.2 billion.

These firms are members of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"). Each DTTL member firm provides services in particular geographic areas and is subject to the laws and professional regulations of the particular country or countries in which it operates. Each DTTL member firm is structured in accordance with national laws, regulations, customary practice, and other factors, and may secure the provision of professional services in its territory through subsidiaries, affiliates, and other related entities. Not every DTTL member firm provides all services, and certain services may not be available to attest clients under the rules and regulations of public accounting. DTTL and each DTTL member firm are legally separate and independent entities, which cannot obligate each other. DTTL and each DTTL member firm are liable only for their own acts and omissions, and not those of each other. DTTL (also referred to as "Deloitte Global") does not provide services to clients.

Deloitte Touche Tohmatsu India Private Limited is one of the DTTL member firms in India, which operates through offices in Ahmedabad, Bengaluru, Chennai, Hyderabad, Kolkata, Mumbai, New Delhi/Gurgaon and Pune.

Their long existence in the Indian professional arena supplements the technical proficiency of the client service teams to create powerful business solution tailored to the client's need.

Deloitte focus on clients, take pride in the ability to provide quality services - whether they are an owner-managed business or a large multinational corporation. Deloitte is a multi-skilled, multi-disciplined firm, offering clients a wide range of industry-focused business solutions. Deloitte recruit the brightest and the best - whatever their specialization. As a firm it combine the dynamism and fluid-thinking of the young graduate, with the business knowledge and insight of the seasoned executive. Investing in the people means Deloitte clients get world-class expertise to solve their complex business problems.

KEY LEARNING

Performing the assigned tasks and undergoing through a rigorous training session at Deloitte, learning about Outpatient Department, Integration of EMR in Outpatient Department and how the offshore support model works was immense. The summary of key learning at Deloitte is mentioned below:-

- Functional Overview of EMR and EMR vendor (name hidden for security purpose)
- Knowledge of the hospital workflow and its integration
- Backend Configuration of the EMR
- Overview of the security access rights of an EMR software users
- Working knowledge of various an EMR software modules
- Ticket Resolving Process
- Understanding Service Level Agreement between the Client and Application support team

Part 2- Dissertation Report

INTRODUCTION

What Are Electronic Health Records (EHRs)?

EHRs are, at their simplest, digital (computerized) versions of patient's paper charts. But EHRs, when fully up and running, are so much more than that. EHRs are real-time, patient-centered records. They make information available instantly, "whenever and wherever it is needed". And they bring together in one place everything about a patient's health. EHRs can: [1]

• Contain information about a patient's medical history, diagnoses, medications, immunization dates, allergies, radiology images, and lab results

• Offer access to evidence-based tools that providers can use in making decisions about a patient's care

• Automate and streamline providers' workflow

• Increase organization and accuracy of patient information

• Support key market changes in payer requirements and consumer expectations

One of the key features of an EHR is that it can be created, managed, and consulted by authorized providers and staff across more than one health care organization. A single EHR can bring together information from current and past doctors, emergency facilities, school and workplace clinics, pharmacies, laboratories, and medical imaging facilities. [2]

EHR in Outpatient Department

Outpatient module is crucial for core clinical functioning of a Hospital or a Clinic as it one of the important point of entry for the patient into a healthcare setting. An Outpatient EHR supports the following features [3]:

- Scheduling of the appointments
- Patient List Management
- Outpatient Department workflow management
- Placing Medication and Lab Orders
- Result(s) Entry
- Result(s) Delivery including faxing and e-mailing of clinical reports
- Reporting and printout

Challenges in EHR Implementation in an Outpatient Department

EHR implementation in the Outpatient setup raises challenges for Information Technology professionals due to various reasons. A successful EHR implementation can yield great results in improving organizational strength and efficiency [4]. On the other hand, a failure can drain an organization of people, funds and vitality. Consequently, many people have struggled over the reasons for the successes and failures experienced with implementations of EHR in an Outpatient setup [5]. This study will analyze the root cause of these commonly occurring challenges post implementation of EHR in an Outpatient setup as well as understanding the trend of these issues over the period of time.

REVIEW OF LITERATURE

1. Benefits and drawbacks of electronic health record systems

Nir Menachemi and Taleah H Collum

Introduction

Over the past decade, virtually every major industry invested heavily in computerization. Relative to a decade ago, today more Americans buy airline tickets and check in to flights online, purchase goods on the Web, and even earn degrees online in such disciplines as nursing, law, and business, among others. Yet, despite these advances in our society, the majority of patients are given handwritten medication prescriptions, and very few patients are able to email their physician or even schedule an appointment to see a provider without speaking to a live receptionist.

Electronic health record (EHR) systems have the potential to transform the health care system from a mostly paper-based industry to one that utilizes clinical and other pieces of information to assist providers in delivering higher quality of care to their patients. The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, which is part of the American Recovery and Reinvestment Act (ARRA) (aka "stimulus package"), was signed into law with an explicit purpose of incentivizing providers (eg, hospitals and physicians) to adopt EHR systems. However, given that a bare-bone EHR system provides only partial benefits to patients and society, the HITECH Act requires that providers adopt EHRs and utilize them in a "meaningful" way, which includes using certain EHR

functionalities associated with error reduction and cost containment. How exactly do EHRs improve care? And what is the current evidence that certain EHR "meaningful use" functionalities will translate into benefits? Answering these questions is the purpose of this paper. Stated explicitly, the purpose of this study is to review the literature on the impacts of EHR. Impacts include both benefits and drawbacks, and, as such, we discuss the advantages and disadvantages that have been identified by researchers and other experts. Overall, we expect that any reader interested in understanding the current state of the knowledge base with regard to EHR benefits will find this paper useful.

Why we need EHRs

EHRs are defined as "a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports". Some of the basic benefits associated with EHRs include being able to easily access computerized records and the elimination of poor penmanship, which has historically plagued the medical chart. EHR systems can include many potential capabilities, but three particular functionalities hold great promise in improving the quality of care and reducing costs at the health care system level: clinical decision support (CDS) tools, computerized physician order entry (CPOE) systems, and health information exchange (HIE). These and other EHR capabilities are requirements of the "meaningful use" criteria set forth in the HITECH Act of 2009.

EHRs and organizational and societal outcomes

Organizational outcomes

Studies examining organizational outcomes have focused on EHR use in both the inpatient and outpatient settings. Such outcomes have frequently included increased revenue, averted costs, and other benefits that are less tangible, such as improved legal and regulatory compliance, improved ability to conduct research, and increased job/career satisfaction among physicians. Increased revenue comes from multiple sources, including improved charge capture/decrease in billing errors, improved cash flow, and enhanced revenue. Several authors have asserted that EHRs assist providers in accurately capturing patient charges in a timely manner. With an EHR system, many billing errors or inaccurate coding may be eliminated, which will potentially increase a provider's cash flow and enhance revenue. Reductions to outstanding days in accounts receivable and lost or disallowable charges can potentially lead to improved cash flow. In addition, EHR reminders to providers and patients about routine health visits can increase patient visits and therefore enhance revenue.

Societal benefits

Another less tangible benefit associated with EHRs is an improved ability to conduct research. Having patient data stored electronically increases the availability of data, which may lead to more quantitative analyses to identify evidence-based best practices more easily. Moreover, public health researchers are actively using electronic clinical data that are aggregated across populations to produce research

that is beneficial to society. The availability of clinical data is limited, but as providers continue to implement EHRs, this pool of data will grow. By combining aggregated clinical data with other sources, such as over-the-counter medication purchases and school absenteeism rates, public health organizations and researchers will be able to better monitor disease outbreaks and improve surveillance of potential biological threats.

Conclusion

In this paper we discussed several advantages and disadvantages associated with an EHR adoption. Many of the benefits accrue to patients and society overall. For these benefits to be realized, the US Government has embarked on an ambitious journey to transition a maximum number of providers toward EHR adoption and "meaningful use". Without ubiquitous use of EHR technologies, experts believe that many efficiencies in the US health care system cannot be realized. The financial incentives built into the HITECH Act are designed to defray some of the costs associated with EHR adoption, especially for smaller organizations where these expenses serve as a major barrier. The financial incentives in HITECH, which are made available through the Medicare and Medicaid programs, are also an attempt to correct some of the misalignment of incentives associated with EHR as discussed previously, especially because the US Government, through the Medicare and Medicaid programs, is the largest insurer in the country.

2. Challenges to EHR Implementation in Electronic- Versus Paper-based Office Practices

Stephanie O. Zandieh MD, MS, Kahyun Yoon-Flannery MPH, Gilad J. Kuperman MD, PhD, Daniel J. Langsam BA, Daniel Hyman MD, MMM, Rainu Kaushal MD, MPH

Background

Challenges in implementing electronic health records (EHRs) have received some attention, but less is known about the process of transitioning from legacy EHRs to newer systems.

Objective

To determine how ambulatory leaders differentiate implementation approaches between practices that are currently paper-based and those with a legacy EHR system (EHR-based).

Design

Qualitative study.

Participants

Eleven practice managers and 12 medical directors all part of an academic ambulatory care network of a large teaching hospital in New York City in January to May of 2006.

Approach

Qualitative approach comparing and contrasting perceived benefits and challenges in implementing an ambulatory EHR between practice leaders from paper- and EHR-based practices. Content analysis was performed using grounded theory and ATLAS.ti 5.0.

Results

We found that paper-based leaders prioritized the following: sufficient workstations and printers, a physician information technology (IT) champion at the practice, workflow education to ensure a successful transition to a paperless medical practice, and a high existing comfort level of practitioners and support staff with IT. In contrast, EHR-based leaders prioritized: improved technical training and ongoing technical support, sufficient protection of patient privacy, and open recognition of physician resistance, especially for those who were loyal to a legacy EHR. Unlike paper-based practices, EHR-based leadership believed that comfort level with IT and adjustments to workflow changes would not be difficult challenges to overcome.

Conclusions

Leadership at paper- and EHR-based practices in 1 academic network has different priorities for implementing a new EHR. Ambulatory practices upgrading their legacy EHR have unique challenges.

3. **How to successfully select and implement electronic health records (EHR) in small ambulatory practice settings**

Nancy M Lorenzi, Angelina Kouroubali, Don E Detmer and Meryl Bloomrosen

Background

Adoption of EHRs by U.S. ambulatory practices has been slow despite the perceived benefits of their use. Most evaluations of EHR implementations in the literature apply to large practice settings. While there are similarities relating to EHR implementation in large and small practice settings, the authors argue that scale is an important differentiator. Focusing on small ambulatory practices, this paper outlines the benefits and barriers to EHR use in this setting, and provides a "field guide" for these practices to facilitate successful EHR implementation.

Discussion

The benefits of EHRs in ambulatory practices include improved patient care and office efficiency, and potential financial benefits. Barriers to EHRs include costs; lack of standardization of EHR products and the design of vendor systems for large practice environments; resistance to change; initial difficulty of system use leading to productivity reduction; and perceived accrual of benefits to society and payers rather than providers. The authors stress the need for developing a flexible change management strategy when introducing EHRs that is relevant to the small practice environment; the strategy should acknowledge the importance of relationship management and the role of individual staff members in helping the entire staff to manage change. Practice staff must create an actionable vision outlining realistic goals for the implementation, and all staff must buy into the project. The authors detail the process of implementing EHRs through several stages: decision, selection,

pre-implementation, implementation, and post-implementation. They stress the importance of identifying a champion to serve as an advocate of the value of EHRs and provide direction and encouragement for the project. Other key activities include assessing and redesigning workflow; understanding financial issues; conducting training that is well-timed and meets the needs of practice staff; and evaluating the implementation process.

Summary

The EHR implementation experience depends on a variety of factors including the technology, training, leadership, the change management process, and the individual character of each ambulatory practice environment. Sound processes must support both technical and personnel-related organizational components. Additional research is needed to further refine recommendations for the small physician practice and the nuances of specific medical specialties.

OBJECTIVES

GENERAL OBJECTIVES:

- Identification of major causes of the incidents occurring in the Outpatient setup.
- Understand and compare the trend of Incidents in 2014 and 2015.

SPECIFIC OBJECTIVES:

- Gather the issues faced after the implementation of the Outpatient module at the client setup.
- To find the count of issue faced by the users.
- To identify and analyze the different types of issues face by the user.
- Root cause analysis of the issues.
- Ways to minimize the Issues.

RESEARCH METHODOLOGY

Research Design

Type of Research: Retrospective Descriptive Research

Sample Design

- Sample Unit: Issue
- Sample Size: 200
- Sampling Technique: Random Purposive Sampling
- Sampling Area: PC hospitals and clinics

Data Collection

- Source: Secondary Data
    - Data was collected from the system database,
    - Data available on Internet and journals.
- Tools

  The data was collected through incident management application.

Data Analysis

Root Cause analysis

Techniques: Frequencies Tables and Pareto analysis

RESULTS

1. **User Service Restoration**.

   User service restoration is the category for the issues that require a build – fix issues. It fixes those functionalities that are supposed to function properly but are not.

   Table 1: Total no. of User Service Restorations for year 2014 and 2015

Total issues	200
User service restoration (2014)	100
User service restoration (2015)	100

2. **Priorities of overall issues:** Priority is decided at the first level of triaging on the basis of the impact and urgency of the issue.

   Table 2: Total no. of User Service Restorations based on the priorities for year 2014

User Service Restorations (2014)	No. of Issues
Critical	19
High	40
Medium	24
Low	17
Total	**100**

Figure 1: Total no. of User Service Restorations based on the priorities for year 2014

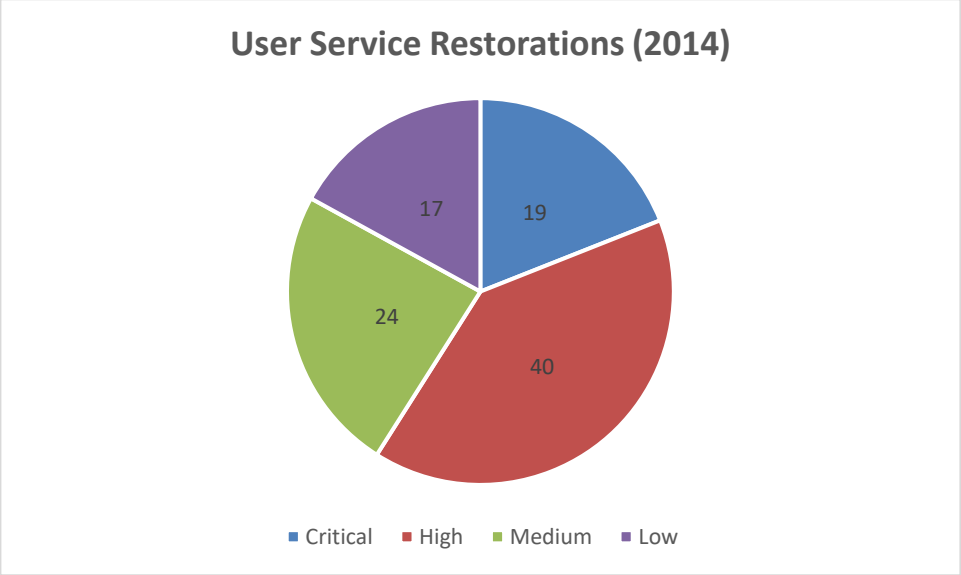
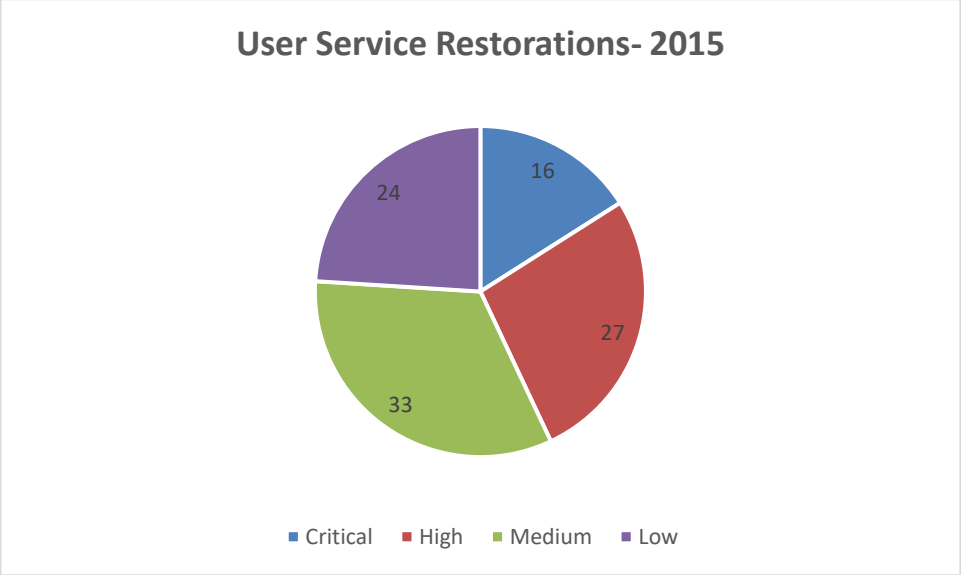


Table 3: Total no. of User Service Restorations based on the priorities for year 2015

User Service Restorations (2015)	Frequency
Critical	16
High	27
Medium	33
Low	24
Total	**100**

Figure 2: Total no. of User Service Restorations based on the priorities for year 2015



3. Root cause analysis of the overall issues:

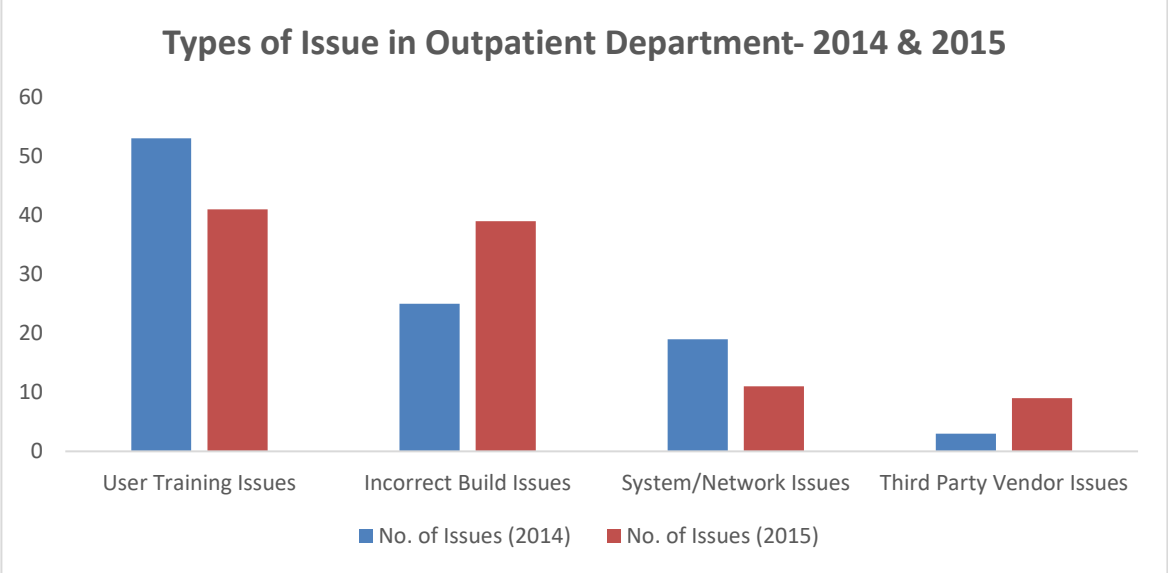
The issues faced by the user after implementation of the Outpatient module can be categorized into 4 major heads-

1) User training issues
2) Incorrect build Issues
3) System/ Network Issues
4) Third party issues

Table 4: Total no. of User Service Restorations based on the types of issues for year 2014 and 2015

User Service Restoration 2014 & 2015		
Types of Issues	**No. of Issues (2014)**	**No. of Issues (2015)**
User Training Issues	53	41
Incorrect Build Issues	25	39
System/Network Issues	19	11
Third Party Vendor Issues	3	9
Total	**100**	100

Figure 3: Total no. of User Service Restorations based on the types of issues for year 2014 and 2015



4. Pareto Analysis

This technique helps to identify the top portion of causes that need to be addressed to resolve the majority of problems. While it is common to refer to Pareto as "80/20" rule, under the assumption that, in all situations, 20% of causes determine 80% of problems, this ratio is merely a convenient rule of thumb and is not nor should it be considered immutable law of nature. In this case, Pareto Analysis techniques is applied to find the root cause of the of issues caused in year 2014 and 2015

Table 5: Pareto Analysis of all the User Service Restorations based on types of issues for year 2014.

User Service Restoration- 2014			
Bucket	**No. of Issues**	**Cum. Frequency**	**Cum. Percentage**
User Training Issues	53	53	53.0
Incorrect Build Issues	25	78	78.0
System/Network Issues	19	97	97.0
Third Party Vendor Issues	3	100	100.0
Total	100		

Figure 4: Pareto Chart of all the User Service Restorations based on types of issues for year 2014.

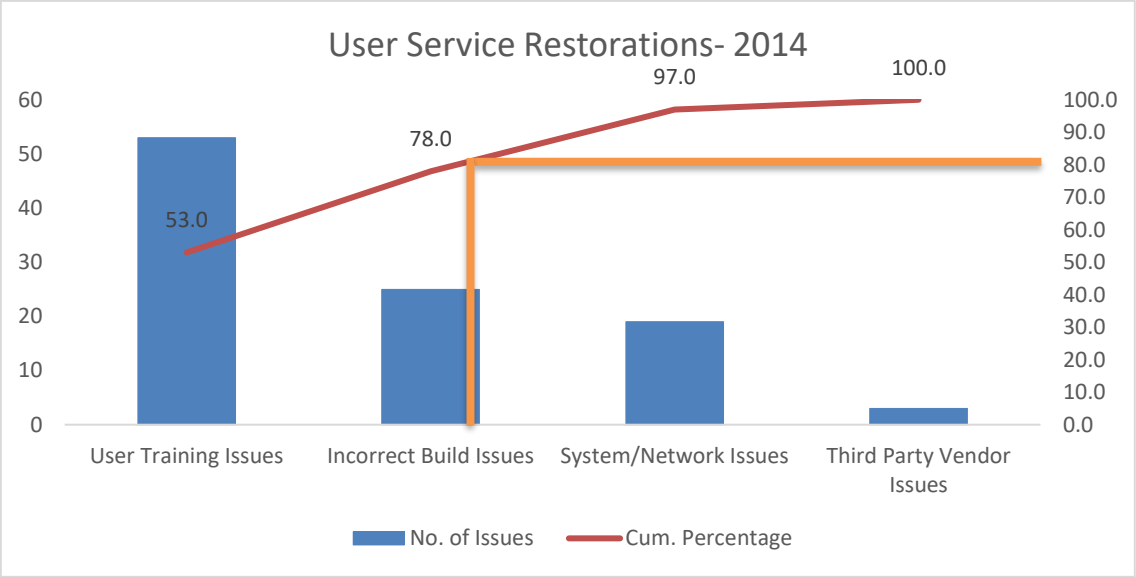
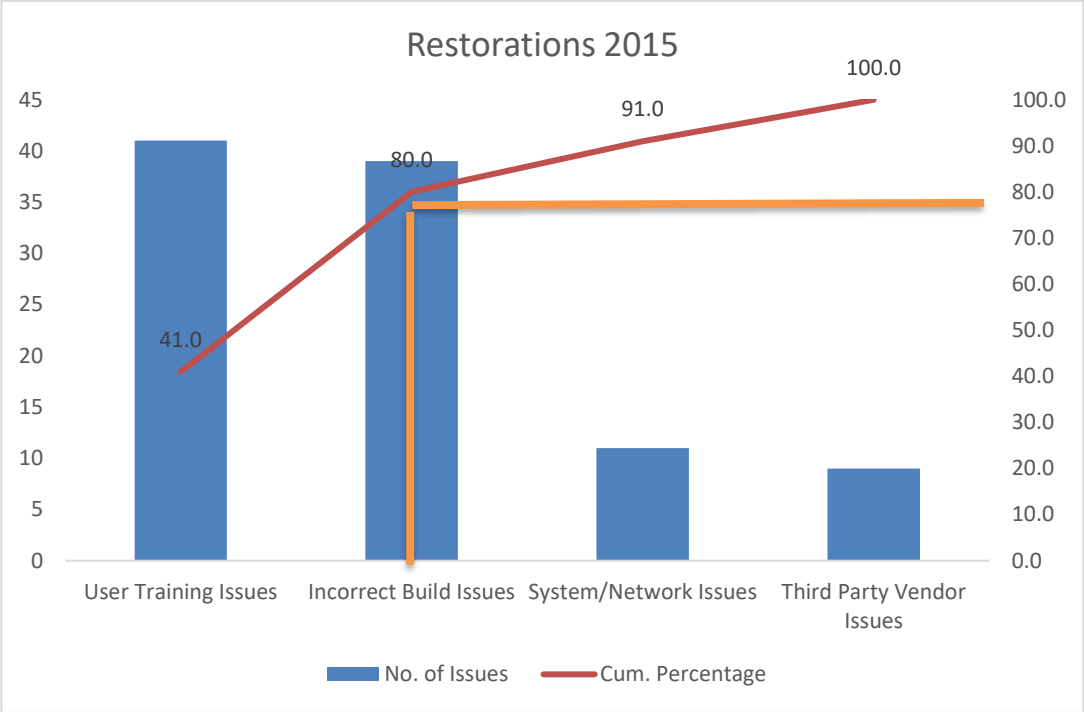


Table 6: Pareto Analysis of all the User Service Restorations based on types of issues for year 2015.

User Service Restoration- 2015			
Bucket	**No. of Issues**	**Cum. Frequency**	**Cum. Percentage**
User Training Issues	41	41	41.0
Incorrect Build Issues	39	80	80.0
System/Network Issues	11	91	91.0
Third Party Vendor Issues	9	100	100.0
Total	100		

Figure 5: Pareto Chart of all the User Service Restorations based on types of issues for year 2015.



The above Pareto Analysis (Table 5 & Table 6 and Figure 4 & Figure 5) shows that out the 4 major heads (User Training Issues, Incorrect Build Issues, System/ Network Issues and Third Party Vendor Issues), User Training and Incorrect Build Issues contribute to 80% of the issues. So according to Pareto Analysis principle, only issues occurring due to User training and Incorrect Build will be considered for the further analysis.

4 (a). Further Analysis

The User Training Issues and Incorrect Build Issues were further categorized and Pareto Analysis Principle was applied to it.

Table 7: Pareto Analysis of all the User Service Restorations under User Training for year 2014.

User Training Issues- 2014			
Issue Categories	**No. of Issues**	**Cum. Frequency**	**Cum. Percentage**
Medications and Orders Issues	19	19	35.8
Application Inbox Issues	11	30	56.6
Patient Visit Issues	8	38	71.7
Printer Issues	7	45	84.9
Patient Visit Notes Issues	5	50	94.3
Patient Chart Issues	3	53	100.0
Total	**53**		

Figure 6: Pareto Chart of all the User Service Restorations under User Training for year 2014.

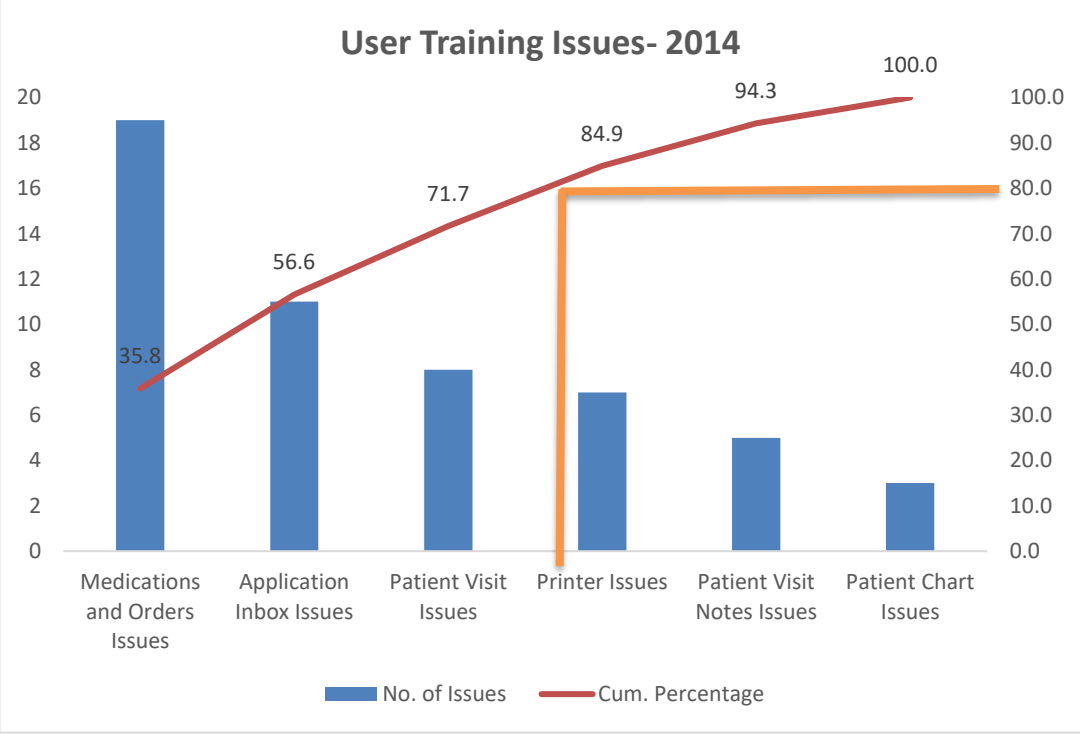


Table 8: Pareto Analysis of all the User Service Restorations under User Training for year 2015.

User Training Issues- 2015			
Bucket	**No. of Issues**	**Cum. Frequency**	**Cum. Percentage**
Medications and Orders Issues	14	14	34.1
Printer Issues	9	23	56.1
Patient Visit Issues	5	28	68.3
Application Inbox Issues	5	33	80.5
Patient Visit Notes Issues	3	36	87.8
Patient Chart Issues	3	39	95.1
Activities	1	40	97.6
Search Toolbar Issues	1	41	100.0
Total	**41**		

Figure 7: Pareto Chart of all the User Service Restorations under User Training for year 2015.

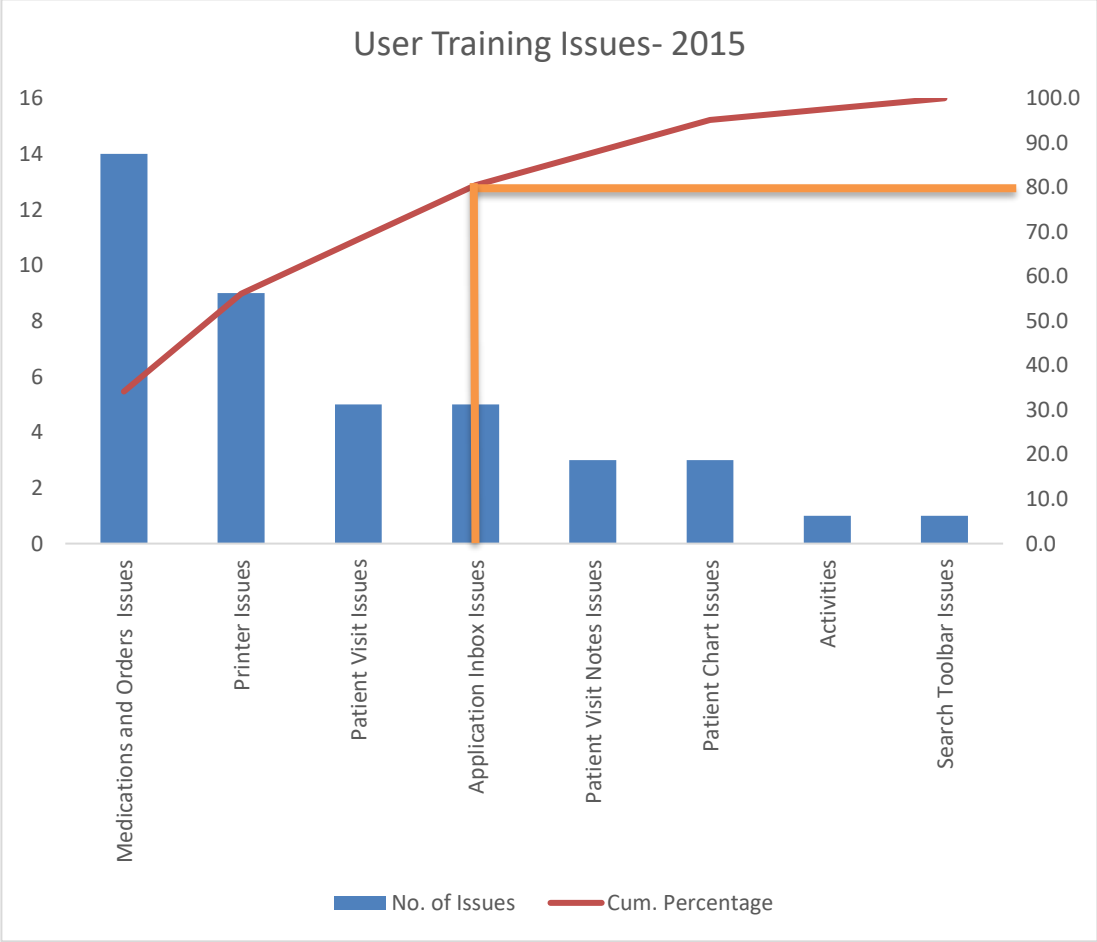


Table 9: Pareto Analysis of all the User Service Restorations under Incorrect Build for year 2014.

Restoration 2014- BR			
Bucket	**No. of Issues**	**Cum. Frequency**	**Cum. Percentage**
Application Inbox Issues	13	13	52.0
Printer Issues	7	20	80.0
Medications and Orders Issues	4	24	96.0
Patient Visit Notes Issues	1	25	100.0
Total	**25**		

Figure 8: Pareto Chart of all the User Service Restorations under Incorrect Build for year 2014.

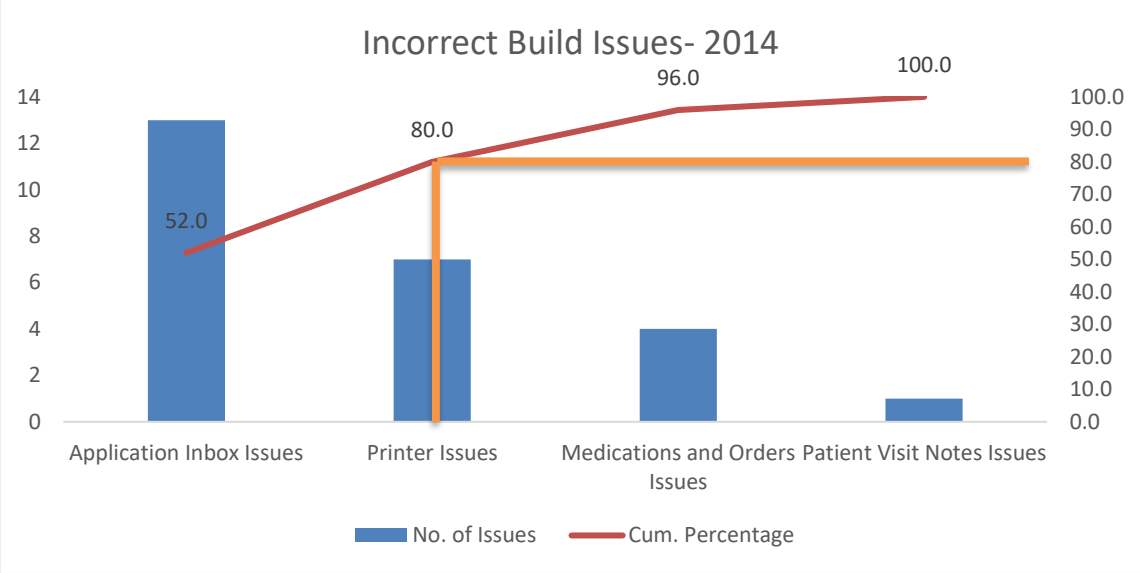
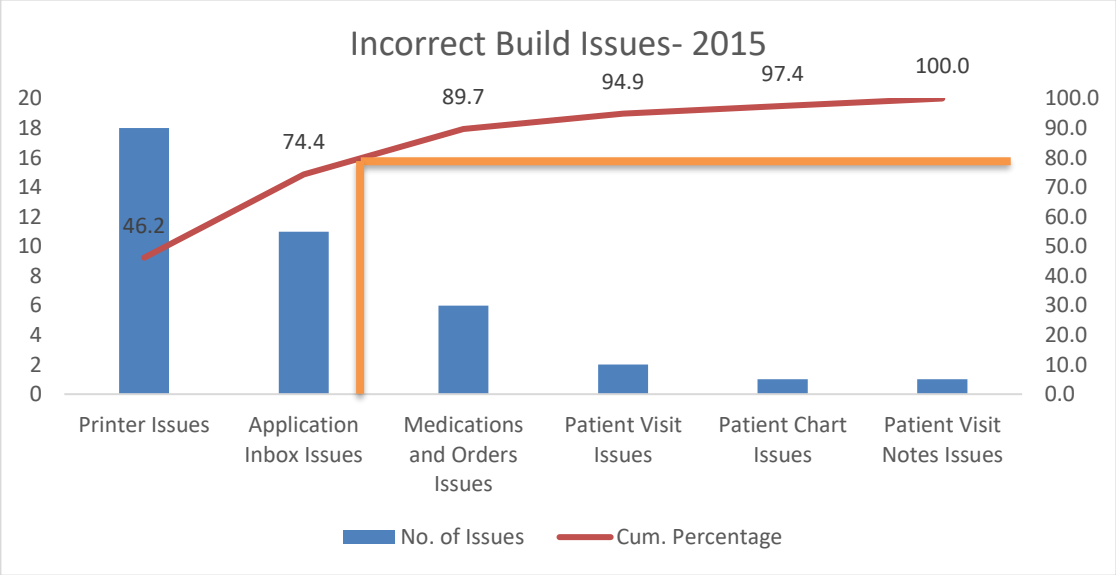


Table 10: Pareto Analysis of all the User Service Restorations under Incorrect Build for year 2015.

Restoration 2015- BR			
Bucket	**No. of Issues**	**Cum. Frequency**	**Cum. Percentage**
Printer Issues	18	18	46.2
Application Inbox Issues	11	29	74.4
Medications and Orders Issues	6	35	89.7
Patient Visit Issues	2	37	94.9
Patient Chart Issues	1	38	97.4
Patient Visit Notes Issues	1	39	100.0
Total	**39**		

Figure 9: Pareto Chart of all the User Service Restorations under Incorrect Build for year 2015.



User Training Issue (2014) - Above Pareto Analysis (Table 7 and Figure 6) shows that out of all the User Training Issues categories, only (i) Medications and Orders Issues (ii) Application Inbox Issues and (iii) Patient Visit Issues will be considered for the further analysis.

User Training Issue (2015) - Above Pareto Analysis (Table 8 and Figure 7) shows that out of all the User Training Issues categories, only (i) Medications and Orders Issues (ii) Application Inbox Issues (iii) Patient Visit Issues and (iv) Printer Issues will be considered for the further analysis.

Incorrect Build Issue (2014) - Above Pareto Analysis (Table 9 and Figure 8) shows that out of all the Incorrect Build Issues categories, only (i) Application Inbox Issues and (ii) Printer Issues will be considered for the further analysis.

Incorrect Build Issue (2015) - Above Pareto Analysis (Table 10 and Figure 9) shows that out of all the Incorrect Build Issues categories, only (i) Application Inbox Issues and (ii) Printer Issues will be considered for the further analysis.

5. Comparative Analysis

All the issues identified to under the various issue categories related to User Training and Incorrect Build for year 2014 and 2015 will be indentified. Common issues found in 2014 and 2015 will be considered for the comparitive analysis.

Table 11: Total no. of User Service Restoration under Medications and Orders Issues, Application Inbox Issues and Patient Visit Issues for year 2014

User Training Issues- 2014	
Issue	**Frequency**
Closing Patient Visit	11
Medication Prescription	8
Receiving Wrong Inbox Messages	6
Creating Patient Visit	4
Placing Lab Order	4
Adding Notes to Closed Visit	3
Sending E- Prescription	2
Total	**38**

Table 12: Total no. of User Service Restoration related to User Training under Medications and Orders Issues, Application Inbox Issues, Patient Visit Issues and Printer Issues for year 2015

Restoration 2015- UT	
Reasons	**Frequency**
Sending E- Prescription	9
Closing Patient Visit	7
Not able to Print	3
Medication Prescription	3
Receiving Wrong Inbox Messages	3
Ordering Vaccination	3
Placing Lab Order	2
Adding Notes to Closed Visit	2
Printer Tray Out of Paper	1
Total	**33**

Table 13: Total no. of User Service Restoration related to Incorrect Build under Application Inbox Issues and Printer Issues for the year 2014

Restoration 2014- BR	
Bucket	**Frequency**
Wrong Printer/ Workstation Mapped	14
Pool Access Not Available	9
e- Prescription not setup	2
Total	25

Table 14: Total no. of User Service Restoration related to Incorrect Build under Application Inbox Issues and Printer Issues for the year 2015

Restoration 2015- BR	
Bucket	**Frequency**
Wrong Printer/ Workstation Mapped	21
Communication Mode Incorrect	4
Preference List Not Updated	4
Pool Access Not Available	5
total	34

Table 15: Total no. of issues occuring commonly under the User Training category for year 2014 and 2015

User Training Issues	**No. of Issues (2014)**	**No. of Issues (2015)**
Medication Prescription	8	3
Sending E- Prescription	2	10
Closing Patient Visit	11	7
Receiving Wrong Inbox Messages	6	3
Placing Lab Order	4	1
Adding Notes to Closed Visit	3	2
Total	**34**	**26**

Figure 10: Total no. of issues occuring commonly under the User Training category for year 2014 and 2015

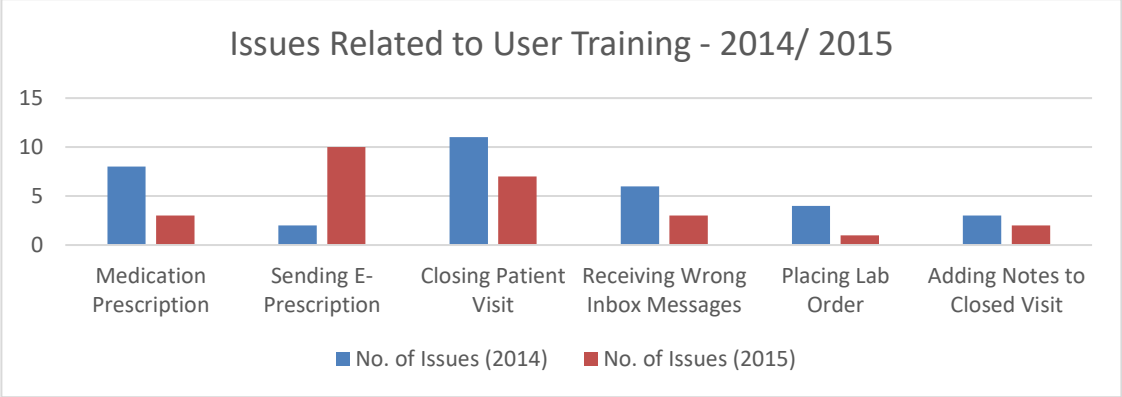


Table 16: Total no. of issues occuring commonly under the Incorrect Build category for year 2014 and 2015

Incorrect Build Issues	No. of Issues (2014)	No. of Issues (2015)
Wrong Printer/ Workstation Mapped	14	21
Pool Access Not Available	9	5
Total	**23**	**26**

Figure 11: Total no. of issues occuring commonly under the Incorrect Build category for year 2014 and 2015

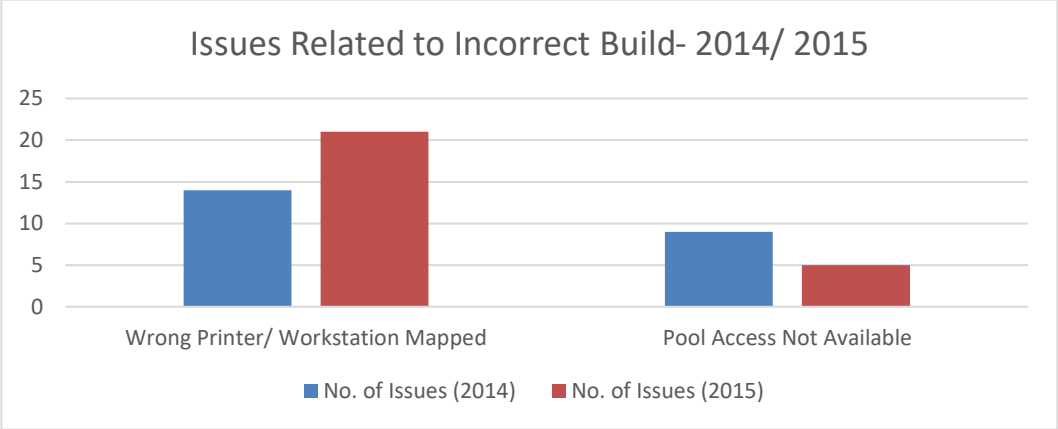


Figure 12: Fishbone Diagram- Causes of E- Prescribing Issues

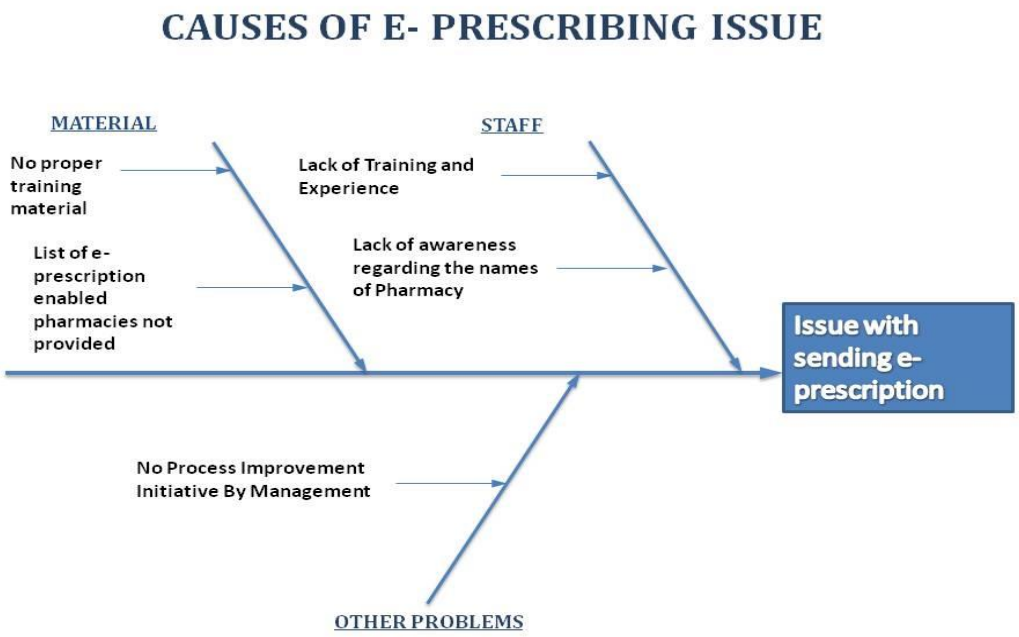
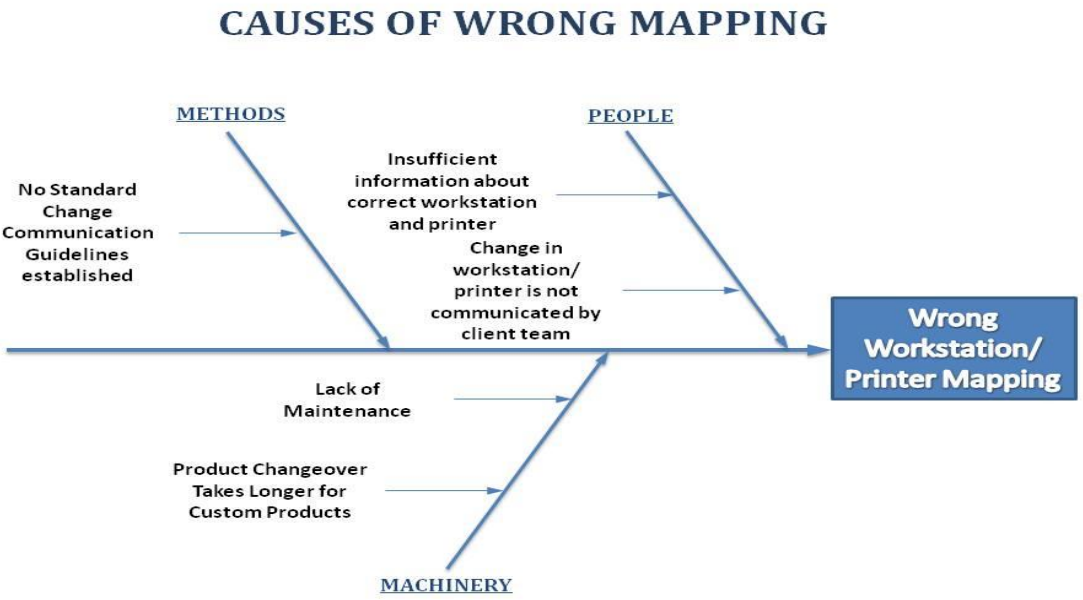


Figure 13: Fishbone Diagram- Causes of Wrong Mapping Issues



DISCUSSION

As part of the project, the root cause analysis of the issues faced by the end users, after the implementation of the EHR in Outpatient Department, has been done.

- The issues raised by the end users that were taken into consideration for this project were 200 User Service Restorations, out of which 100 issues were taken from year 2014 and 100 issues were taken from 2015. If the issue is about a functionality is not working for the concerned user, then it is termed as User service restoration issue.
- Outpatient EHR is implemented in across the clinics and hospitals in the US. As the Outpatient department is very crucial part of healthcare and it directly impacts the patient care. So on the basis of the impact on patient care, the priority of the issues can be categorized into 4 levels, i.e., Critical, High, Medium and Low.
- The critical issues, as the name suggests, are those which have the highest impact on the patient care and are extremely urgent. Such issues have to be resolved in the least time period.
- The analysis of the issues reveal that out of 100 issues analyzed for the year 2014, 19 were critical, 40 were high priority issues, 24 were that of medium priority and remaining 17 were that of low priority. So the critical issues accounts for 19% of the issues after the implementation of the Outpatient EHR, high issues being the maximum of all accounts for 40% of the issues, medium issues accounts for 24% of the issues and issues with low priority accounts for 17% of the issues.

- The analysis of the issues reveal that out of 100 issues analyzed for the year 2015, 16 were critical, 27 were high priority issues, 33 were that of medium priority and remaining 24 were that of low priority. So the critical issues accounts for 16% of the issues after the implementation of the Outpatient EHR, high issues of all accounts for 27% of the issues, medium issues being the maximum accounts for 33% of the issues and issues with low priority accounts for 24% of the issues.
- This exhibits that in the post implementation of EHR Outpatient Department of the clinics or the hospitals, the issues that required urgent or immediate action has reduced over a period of time and most of the issues can be addressed within relaxed time frame, but still few issues require immediate action as these issues might be responsible for impacting the patient care.
- The root cause analysis of the all the issues, for both years, reveals that there are 4 major categories in which all the issues raised by the end user after the implementation of the Outpatient EHR, can be categorized into. They are:
    - User training issues
    - Incorrect build
    - System/ Network Issues
    - Third party issues
- User training issue: the users are supposed to receive training from the implementation team or the support team. But sometimes due to the tight schedule of the end users or the team the training either does not happen at all or is incomplete. There have been so many issues where the users were not able to perform their roles because either they were not aware about a particular

functionality or they were performing the action in a wrong way and they raised the issue without knowing that there was no fault in the application. Such issues can be avoided if timely refresher training are given to the end user and all the developments are communicated to the end users about a new workflow.

  - The analysis of the issues reveal that out of 100 issues raised by the end users in year 2014 and 100 issues raised in year 2015, 53 and 41 issues were that of user training issues, respectively. This constitutes 53% of the total issues in 2014 and 41% of total issues in year 2015. This suggests that over a period of time user training issues have decreased considerably but still they contribute to the majority of issues and can be resolved by merely training the users before they start working on the application, any change in the workflows in the application or any upgradation in the application.

- Incorrect build issues: there are number of functionalities that the end user can perform as part of their scope of work in the Outpatient EHR. If any of these functionalities is not working for a particular user or a bunch of users with the same or different scope of work, that implies that there is something wrong with the back end configuration. In such a scenario the application support personnel has to navigate in the application, try to replicate the issue. If the personnel are also confident that there is a break in the backend configuration, they make the required changes in the backend.

  - The analysis of the issues reveals that out of 100 issues raised by the end users in year 2014 and 100 issues raised in 2015, 25 and 39 issues were that of incorrect build respectively. This constitutes 25% of the total issues in

year 2014 and 39% issues in year 2015. This suggests that over a period of time the issued related to incorrect build has increased and still some of the application is not stable.

- System/ Network Related Issues: These issues comprises all the issues occurring within the application which automatically resolves for e.g. issues related to network connectivity, hardware requires restart and server related issues.
    - The analysis of the issues reveal that out of 100 issues raised by the end users in year 2014 and 100 issues raised in 2015, 19 and 11 issues were that of System/ Network issues respectively. This constitutes 19% of the total issues in year 2014 and 11% in 2015. As these issues get automatically resolved, application support team cannot do much in this except for guiding the user if it is a known issue.
- Third Party Issues: These are the issues which requires the action from the application vendor. The application support team can only work on these issues only after the action has been taken application vendor.
    - The analysis of the issues reveal that out of 100 issues raised by the end users in year 2014 and 100 issues raised in 2015, 3 and 9 issues were that of Third Party issues respectively. This constitutes 3% of the total issues in year 2014 and 9% in 2015. All these issues are very rare.
- To find the root cause responsible for the 200 issues raised by the user, further analysis is required. For further analysis, Pareto Analysis Principle was applied to these 4 major categories and only 80% of the major issues were taken in the

considerations. Result Pareto Analysis revealed that User Training and Incorrect Build were responsible for 80% of the issues for both years.

- The User Training issues and Incorrect Build issue were further categorized into various issues respectively and Pareto Analysis principle was applied to these categories for further analysis. The result of Pareto analysis revealed that 80% of the User Training issues in year 2014 were related to medication and orders, application inbox and patient visit; and issues in year 2015 were related to medication and orders, application inbox, patient visit and printer. 80% of the Incorrect Build Issues were related to Application inbox and Printer for both 2014 and 2015.
- Comparative Analysis: All the issues under the identified categories that were taken into were listed and a comparative analysis for the commonly recurring issues for the both the years was done. The result of the comparative analysis revealed that all the User Training issues have reduced over the period of the time except for the issue with sending e- prescription, which has increased from 2 issues in 2014 to 10 issues in 2015. For Incorrect Build issues, the result of comparative analysis revealed that issue with printer/ workstation mapping has increased from 14 issues in year 2014 to 21 issues in year 2015.

CONCLUSION

The analysis of these issues reveals that out of 200 issues analyzed, the root cause of the major issues i.e. User Training and Incorrect Build, occurring over the period of time were due to training issues with sending e- prescriptions and build related issues due wrong workstation/ printer mapping. The reason for majority of the issues with sending the e-prescription is that user are not aware about the names of all the pharmacy included where e- prescriptions can be sent. Most of the issues related to wrong printer and workstation mapping occurs because the team which physical setups are the workstation and printers does not communicate effectively to application support team regarding update or change in the printer or the workstation so that they can update the changes in the application, thus affecting the normal functionality expected from the application. The occurrence of these issues have increased over the period of time and thus requires appropriate action to be taken to reduce the increased User Service Restoration count.

RECOMMENDATIONS

1. Issue with sending e- prescription: The major cause for the occurrence of these issues is that end users are not aware about names of all the pharmacies with the facility of receiving e- prescription. To overcome this issue, all the users should be provided with the updated list of all the e- prescription enabled pharmacies with the exact name that reflects in the application. Also any update in the list should be communicated immediately and effectively.
2. Issue with wrong printer/ workstation mapping: To avoid the recurrence of these issues, an effective and robust communication plan should be devised to maintain a timely and proper communication between the team that setups the printers and workstation physically and the application support team, so that a printer or a workstation can be setup in the application for the user as soon as there is any change in the physical setup of the same.

BIBLIOGRAPHY

1. Menachemi N, Collum TH. Benefits and drawbacks of electronic health record systems. *Risk Management and Healthcare Policy*. 2011;4:47-55. doi:10.2147/RMHP.S12985.
2. Zandieh SO, Yoon-Flannery K, Kuperman GJ, Langsam DJ, Hyman D, Kaushal R. Challenges to EHR Implementation in Electronic- Versus Paper-based Office Practices. Journal of General Internal Medicine. 2008;23(6):755-761. doi:10.1007/s11606-008-0573-5.
3. Lorenzi NM, Kouroubali A, Detmer DE, Bloomrosen M. How to successfully select and implement electronic health records (EHR) in small ambulatory practice settings. BMC Medical Informatics and Decision Making. 2009;9:15. doi:10.1186/1472-6947-9-15.
4. Overcoming barriers to electronic medical record (EMR) implementation in the US healthcare system: A comparative study. Health Informatics Journal December 2010 16: 306-318.
5. Hillestad, Richard, et al. "Can electronic medical record systems transform health care? Potential health benefits, savings, and costs." Health Affairs 24.5 (2005): 1103-1117.
6. Makoul G, Curry RH, Tang PC. The Use of Electronic Medical Records: Communication Patterns in Outpatient Encounters. Journal of the American Medical Informatics Association : JAMIA. 2001;8(6):610-615.