ANALYSIS OF THE MAJOR ISSUES OF THE INCIDENCE OCCURRING POST IMPLEMENTATION OF LIS

Internship Training
at
Deloitte Consulting US India Pvt. Ltd. Bengaluru

By
Sakshi Garg

Under the guidance of
Dr. Vijay Pratap Raghuvanshi

MBA Hospital & Health Management
2013–15

Institute of Health Management Research
Jaipur
2015

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INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

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This is to certify that **Dr. Sakshi Garg**, student of MBA Hospital and Health Management from IIHMR University, Jaipur has undergone internship training at **Deloitte Consulting US India Pvt Ltd, Bengaluru** from **9th February 2015 to 15th May 2015**.

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

The Internship is in fulfillment of the course requirements. I wish her all success in all her future endeavors.

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This is to certify that Ms. **Sakshi Garg** was on a fixed term Internship from **February 09, 2015** to **May 15, 2015**. She has successfully completed her Internship in **Application Management Services**.

We wish you the very best in your future endeavors.

Yours truly,

For Deloitte Consulting India Pvt. Ltd.

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This is to certify that the dissertation titled "**Analysis of the major causes of incidents occurring post implementation of an LIS**" submitted by **Dr Sakshi Garg**, Enrollment No. IIHMR/PGDHM/2013-15/1492 under the supervision of **Vijay Pratap Raghuvanshi** for award of MBA Hospital and Health Management of the university carried out during the period from **9th February, 2015 to 15th May, 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.

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Abstract:

Abstract: Analysis of the major causes of the incidents occurring post implementation of a Laboratory Information System (LIS)

Keywords: Post Implementation, LIS, Major Head, Bucket, Filtering, Causes

Aim: To identify the major causes of the incidents occurring post implementation of LIS

Objective: To access root cause analysis to evaluate the causes for delay in laboratory procedures in LIS for US based clients

Methodology: A six month retrospective study post implementation of LIS was carried out and the problems that arose were analyzed. Filtering of incidents in the form of tickets was done. The buckets were taken into consideration to analyze the actual problem. Thereby, identifying the root cause of incidents over a period of 6 months (May 2014-October 2014).

Results: The study analyses the issues faced by the end users after the implementation of LIS. All the closed issues over the period of 6 months (May 2014- October 2014) were gathered and categorized into various major heads. The four major causes of issues over past 6 months were categorized into User Access, Import and configuration process, Interface and Printer configuration /setup. Common causes of training and communication: user navigates into wrong screen, user places wrong orders, not aware of activities available in that screen, don't know how to verify the report, duplication of orders, not able to complete order, printing multiple labels, test cancelled with no proper information.

(Please Note: Some part of the data has been kept confidential as per Non Disclosure Agreement with Deloitte Consulting US India)

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Dr Sakshi Garg

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PHI	Protected Health Information
AMS	Application management services
GUI	Graphic User Interface
ERP	Enterprise Resource Planning
EMR	Electronic Medical Record
HER	Electronic Healthcare Record
AMS	Application management services
HIS	Hospital information system
LIS	Laboratory information system
HIMSS	Healthcare Information and Management Systems Society
AP	Anatomical Pathology
CP	Clinical Pathology

Section A. Introduction

A **hospital information system** (HIS) is an element of online file transfer protocol that focuses mainly on the administrational needs of hospitals. In many implementations, a HIS is a comprehensive, integrated information system designed to manage all the aspects of a hospital's operation, such as medical, administrative, financial, and legal issues and the corresponding processing of services. [3]

A **laboratory information system** (LIS) is a software system that records, manages, and stores data for clinical laboratories. A LIS has traditionally been most adept at sending laboratory test orders to lab instruments, tracking those orders, and then recording the results, typically to a searchable database. The standard LIS has supported the operations of public health institutions (like hospitals and clinics) and their associated labs by managing and reporting critical data concerning "the status of infection, immunology, and care and treatment status of patients. [4]

Functions that a LIS has historically performed include, but are not limited to [4]:

- Patient management, including admission date, admitting physician, ordering department, specimen type, etc.
- patient data tracking
- decision support, including comparisons of lab orders with their respective ICD-9 codes
- test ordering
- quality assurance
- workload and management reporting
- workflow management
- billing

Clinical vs. anatomic pathology LIS

The laboratory information system has been primarily segmented into two broad categories (though other variations exist): the clinical pathology and anatomic pathology LIS. [4]

In clinical pathology the chemical, hormonal, and biochemical components of body fluids are analyzed and interpreted to determine if a disease is present, while anatomic pathology tends to focus on the analysis and interpretation of a wide variety of tissue structures, from small slivers via biopsy to complete organs from a surgery or autopsy. These differences may appear to be small, but the differentiation in laboratory workflow of these two medical specialties has led to the creation of different functionalities within LISs. Specimen collection, receipt, and tracking; work distribution; and report generation may vary — sometimes significantly — between the two types of labs, requiring targeted functionality in the LIS. Other differences include [4]:

- Specific dictionary-driven tests are found in clinical pathology environments but not so much in anatomic pathology environments.
- Ordered anatomic pathology tests typically require more information than clinical pathology tests.
- A single anatomic pathology order may be comprised of several tissues from several organs; clinical pathology orders usually do not.
- Anatomic pathology specimen collection may be a very procedural, multi-step processes, while clinical pathology specimen collection is routinely simpler.

LIS implementations fail more often than hospital administrators would like to acknowledge. There are three common scenarios of LIS implementation failure. An implementation may start well but may never be completed. The common reason for this is inflexibility of the LIS software, inexperienced implementation teams or a weak administrative will. Another scenario is where the LIS implementation has been completed but only part of the LIS functionality has been implemented. It is also not uncommon to find that a year or so after a ‘successful’ LIS implementation, the hospital staff have stopped using the software. This might be either because the software was not user friendly or the workflows were not well planned and configured. [5]

Pre-implementation assessment: A hospital administrator who is planning to implement a LIS software in his hospital may thus be apprehensive that the implementation may end in a complete or partial failure. Prevention of this eventuality starts even prior to purchase of the software. The software, the vendor, as well as the hospital need to be well assessed. [5]

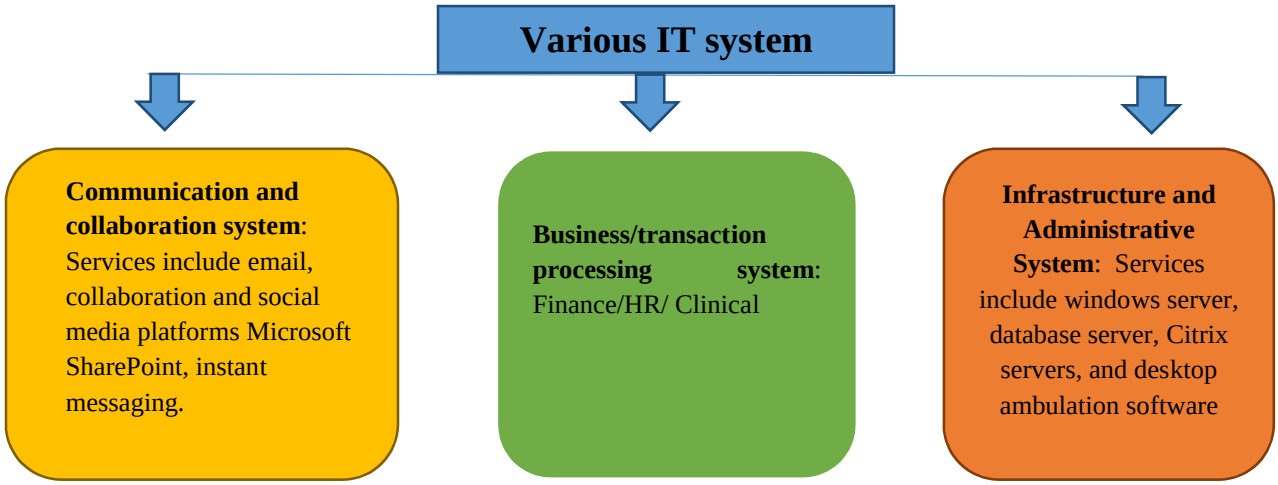
Software assessment: Many popular LIS software, have a common development cycle. Very often a software begins life as computerization of a single hospital, either by an in-house team or by a local developer. Successful implementation leads to a vision of exporting this software to other hospitals. For this, some 'de-customization' is done to allow the software to adapt to workflows that may be different in other hospitals. However, in spite of this, the second implementation site does experience problems. In order to get over this problem, developers tweak the software and apply multiple patches, which though it solves some of the problems, but only at the cost of disrupting the software structure. While the second site still struggles, a third and a fourth hospital get roped in. At some stage, usually years down the line, the developer, if he is still financially sound, decides to rewrite the entire software from scratch so as to increase its flexibility and customizability. This is the 'second generation' software. Hospital administrators shopping around for a LIS software should try to discover if their software is a 'second generation' one. Another aspect for consideration is whether the software customization during implementation is done primarily via master tables or it is via programming code. The former allows the hospital to make some alterations to the software setup on its own, should it be required later on. Programming code, on the other hand, necessitates the hospital to approach the developer each time they want to alter the software functionality. A warning sign is if the vendor promises to implement a LIS software in an unusually short duration of time. A proper implementation takes time and the hospital may do itself harm by trying to unnecessarily hasten the process. [5]

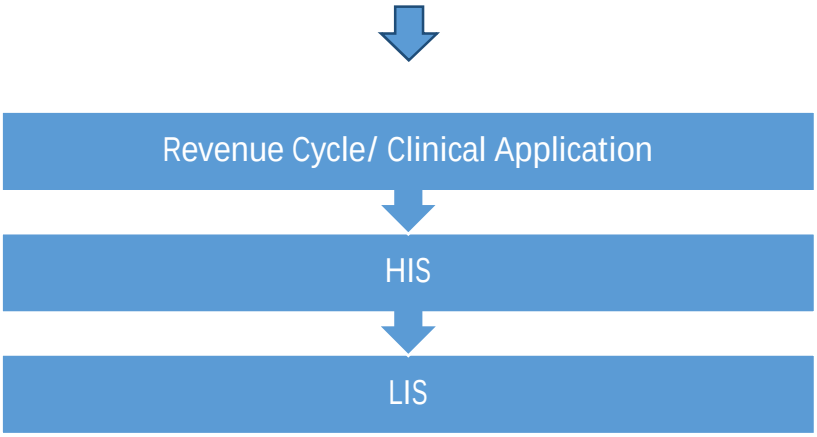
Vendor assessment: Assessing the vendor is also not easy. Only a few vendor of national or international repute may easily be trusted, but with the drawback that a large vendor may not go out of the way to accommodate all the requirements of a small hospital. In case of smaller vendors, the hospital administrator may need to assess the vendor by indirect means, since vendors may not be direct about revealing their shortcomings. A good way to assess the long-term stability of the vendor is to try and discover their staff attrition rate.

This can indicate whether the current implementation team will last the entire implementation cycle. Often, vendors have other business interests; LIS implementation being only one of the side businesses. [5]

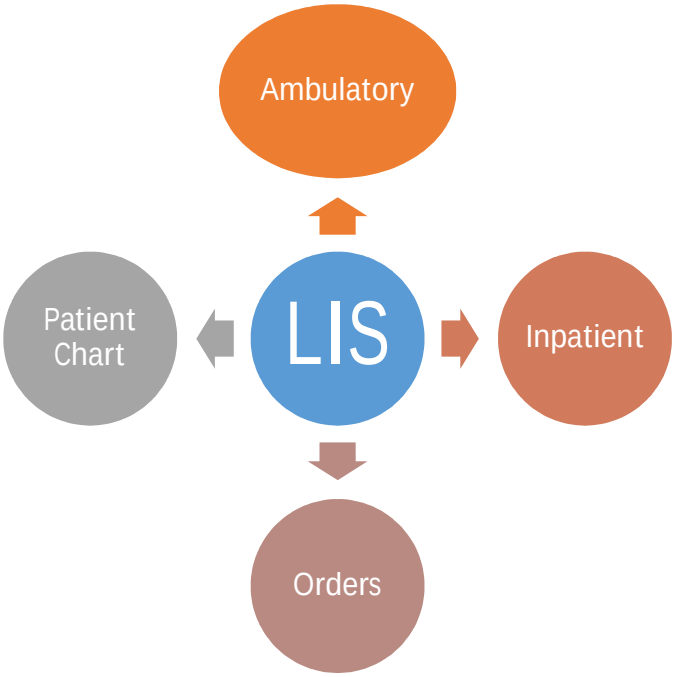
Visits to other implementation sites need to be properly planned to gain a real insight. Usually the vendor is interested in showcasing only the successful implementations. The hospital administrator would do well to get a list of all hospitals that have purchased the software and visit even the ones that the vendor is not keen on showing. It is here where actual problems are likely to come out in the open. During site visits, it is simply not sufficient to see what the software has achieved, but it is necessary to find what the site hospital wanted to implement but could not. This requires meeting the person who actually planned and spearheaded the LIS implementation, since others are unlikely to know what was planned that could not be achieved. [5]

System implementation efforts offer extraordinary challenges to information technology professionals and the organizations impacted by the implementations. A successful implementation can reap vast rewards in organizational strengths and efficiencies. A failure can drain an organization of people, funds and vitality. Consequently, many people have puzzled over the reasons for the successes and failures experienced with these implementations. This study will examine this issue through analysis of closed incidents. [6]





LIS is not a standalone application only but also receives the data from all the core healthcare units of the hospital:



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:[7]

- Contain information about a patient's medical history, diagnoses, medications, immunization dates, allergies, radiology images, lab and test 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. [7]

Health information technology (HIT)

Health information technology (HIT), notably e-prescribing and electronic health records (EHR), have the potential to improve the quality of care, reduce medication errors and adverse events, and decrease overall health care utilization and costs. However, India continues to lag behind other countries in the adoption and use of HIT. The growth of managed care in U.S has fueled expectations for a more coordinated delivery of clinical services and a reduction of unnecessary utilization. Among the most important issues that constrain these expectations is the transfer of medical information. Electronic medical record systems appear to offer substantive advantages over paper records for both containing costs and improving the quality of care. However, incorporation of EMR systems into practice settings has languished. Among the barriers to implementation are software problems of codification and entry of data, security issues, and a dearth of integrated delivery systems, reluctant providers, and prohibitive costs. [8]

E-prescribing and EHR are both electronic means to provide better coordination of care by enabling various health care professionals to access patient medical records. Widespread

adoption of HIT can be especially helpful for the elderly, since this population tends to have more chronic conditions requiring poly pharmacy. Adoption of e-prescribing can reduce medication errors due to poor handwriting, while EHR can promote better clinical outcomes, improve medication adherence and refill rates, improve member satisfaction, and lower overall health care expenditures. Unfortunately, barriers to the adoption of e-prescribing and EHR still exist, including resistance to learning new technology, initial start-up costs, delay in seeing a return on investment, lack of a standardized platform, increased administrative burden, and misaligned incentives. In an effort to promote greater adoption of e-prescribing and EHR, the Centers for Medicare & Medicaid has designed several initiatives, and other private organizations are now becoming more involved to close the HIT gap. [8]

Section B. Literature Review:

Brief Historical Overview: The processes used to collect, process, and store patient information to aid clinical treatment are probably as old as medicine. The formats for collection of patients' records and the ways in which this information is used and subsequently stored for future references has continued to evolve from regular paper note takings to electronic taped records and present-day hospital information technologies. Wilcke (2008) defined information literacy that affects medical practice as the ability to identify the need for information and seek, evaluate, and use information in any presented format. Information technology infusion that aids globalization refers to the degree to which various information technology tools integrate into organizational activities (Idowu et al., 2006).The growth of computer technology in the 1980s with consequent improvement in information literacy saw the advent of the first breed of hospital information systems (Keenan et al., 2006). Earlier researchers in hospital information systems categorized them into three types: Consumer informatics, medical and clinical informatics, and bio informatics based on areas of application (Detmer, 2001). [9]

Consumer informatics focuses on communications between patients and the public. According to Svensson (2002), consumer informatics helps to create virtual communities

for sharing of health care Information. Medical and clinical informatics applications relate directly to health care organizational processes, structure, and clinical outcomes. Electronic medical records system is a major medical and clinical information system aimed at the lowering cost of health care therapies (Svensson, 2002), In its earliest applications, hospital information systems were mostly used for patient's electronic record keeping, but has advanced into almost all areas of medical discipline. Common applications of hospital information technologies include Computerized Physician Order Entry, Pharmacy Information Systems, Laboratory Information Systems, Radiology Information System and Picture Archival and Communication Systems, telemedicine, and many others as these technologies are constantly evolving. William and Boren (2008) acknowledged that most European countries and the United States are increasingly adopting electronic medical record (EMR) technology to enhance health care outcome and quality. [9]

Benefits of Hospital Information Systems: Hospital Information Systems improve workflow and increase patients' access to health care (Ouma& Herselman, 2008; Shekelle et al., 2006; Wallis 2007). Sisniega (2009) asserted that the applications ofinformation and communication technologies facilitate ubiquitous and instantaneous communicationbetween organizations and their stakeholders. ICT enable people and organizations to achieve seamlessworkflow and effective processes through improved interactions. Electronic health technologies enableeffective networking by physicians, allow online review of patients' treatment, and provide for accurateprescription of drugs. Radiology information systems enable the transmission of radiological images forevaluation in remote sites (Weimar, 2009). [9]

Electronic data interchange is part of the applications of a robust and integrated electronic healthrecord system. The type of integrated system envisioned by President Bush's administration is aimed atwarehousing the health care information of all Americans in a national database by 2014 (Thielst, 2007).Electronic data interchange primarily is aimed at achieving seamless continuity of care, irrespective ofpatient migration from one clinician to another or from one city to another. [9]

A study on electronic medical records by Keenan et al. (2006) found improvement in daily work andenhanced patient care: (a) medication turn-around times fell from 5:28 hours to

1:51 hours; (b) radiologyprocedure completion times fell from 7:37 hours to 4:21 hours; and (c) lab results reporting times fell from31:3 minutes to 23:4 minutes. In the same study, transcribing errors for orders declined, and length ofhospital stay decreased. Other benefits of electronic medical records systems are possibility for onlinemonitoring of vital signs, capability for multi-site review of patients' records, and improved physicians'collaboration in patient care. EMR facilitates easy access to medication administration records, sharing ofconsultation reports, and decreased transmit time of test results by reducing the time taken to deliverpaper versions (Keenan et al., 2006). [9]

A major challenge that exists for health care systems is the integration of software systems that can service the various needs of the organization. Stone, Patrick, and Brown (2005) opined that effective organization creates specific and strategic objectives, including objectives related to the clinical and operational strategies (p. 33). Failing to address the interrelationships that exist between the strategies can result in unforeseen negative consequences (p. 34). In the implementation of an electronic medical record, an organization that fails to identify the need for the EMR system to communicate or integrate with the billing software may likely encounter increase process failures requiring additional resources for correction. Successful organizations develop strategies capable of identifying organizational needs. Such organizations anticipate challenges and launch remediation efforts by installation of computer networks and systems (Stone et al., 2005) [9]

A positive correlation is found between adoption of health care information technology and positive organizational financial performance in general, and operationally (Weimar, 2009). This observation is thought to emanate from superior organizational performance by health care providers using novel information systems (Menachemi, Burkhardt, Shewchuk, Burke, & Brooks, 2006). In the general industry, electronic commerce transactions have enabled banking and the retail industry to lower cost of services and improved ease of access to products for their customers by using the Internet (Sisniega, 2009). [9]

Attributes of superior organizational performance in health care include improved quality of care and patient safety. Morath and Turnbull (2005) recommended creating a culture of safety in health care organizations by recognizing and accommodating the multiple complexities of those organizations. A laudable approach could be to take advantage of the

ability of large-scale data systems to amass information as means of identifying significant trends, and enable creation of blame-free sanctuaries in which care errors and observations of incompetence receive prompt solutions. Data production and collection requires knowledge to facilitate this undertaking. Various forms of knowledge are essential business asset used for development of new products and services, thereby useful in developing a competitive advantage in the marketplace (Rennolls & AL-Shawabkeh, 2008). [9]

Cohan (2005) expressed a contrary view that investment in information technology does not necessarily transcend to improvement in productivity. Cohan stressed that shortfall in productivity expectations have made industrial leaders more cautious in adopting information technology in their organizational processes. Presenting a balanced view, Farquharson (2009) asserted that adoption of information technology increases productivity but falls short of expectation in improvement of productivity considering the high capital investment required for implementation. Farquharson surmised that industry productivity paradox exists to some extent with implementation of ICT. Furukawa, Raghu, Spaulding, and Vinze (2006) argue that hospital information systems enhance quality of health care delivery and safety. [9]

The LIS industry has accepted the challenge and developed innovative software solutions that include patient result verification, the recognition of critical values in addition to the immediate transfer of critical values to physicians for evaluation, and enhanced turnaround time (Harrison & McDowell, 2008). Interfacing software is available to merge the laboratory information operating systems with electronic health record (EHR) systems, enhancing the continuum of communication among providers. [9]

Stone, et al. (2005) and Harrison and McDowell anticipated the future of LIS and EHR will provide for increased patient safety, enhanced quality of care, and a leaner operating system resulting in efficient and productive processes. Woodside (2007) concur that health care organizations use electronic data interchange to share patient histories, treatment plans, lab results, and insurance information. Sharing the patient's history in an exchange facilitates initiation of care and decreases the chances of errors. Data interchanges that involve physician's orders and pharmacies can protect the patient by detecting prescriptions of incompatible drug combinations, and highlighting potential allergens to patients. Another

vital function of the electronic interchange is the verification of insurance benefits. Many providers do not run tests, ship supplies, or provide care without assurance that the patient has insurance coverage and that the insurance company has authorized the expenditures. Electronic interchange between entities helps avoid delays in the approval process and decrease the possibility of poor outcome because of a delay in treatment. [9]

Information technology in general enables intra organizational networking that facilitates effective information flow within the various units of a firm. In the world of an organization's complex network, workforce diversity, and departmentalization, information can become lost in a milieu of activities; hence, decision-making, schedule of responsibilities, and an information flow chart are necessary for effective organizational operations (Hargie & Dickson, 2007). In addition to prompt delivery of investigation reports to patients and clinicians, some aspects of information technology enable decisions made on organizational processes to be timely and effectively disseminated to the workforce. Analytical software systems provide means for both dissemination of information and relevant quantitative data to support management decisions. [9]

Analytical information systems help organizations to maintain a competitive edge in the marketplace by increasing operational speed and maintaining fluidity of information flow (Azevado, Ferraira, & Leitao, 2008). Crane and Crane (2006) reported that numerous solutions for the medication error problem in hospital settings might be averted with the use of an integrated systems approach. However, execution of an organization's integrated electronic medical record without use of communication billing software may escalate process breakdowns. [9]

Phillips (2009) stated that the use of an integrated system offers considerable conceptual flexibility and data integration capabilities instead of using one module for electronic records. An integrated records system promotes a user-interface with e-records repository to facilitate storage and eventual retrieval of records. [9]

Section C. Background:

Information technology supporting the work of physicians and nurses may help to improve patient safety, quality of care and organizational. Despite the many positive effects IT systems can have the IT adoption rate in healthcare varies strongly between medical specialties, types of organizations and countries. Surveys spanning many countries are traditionally conducted by international organizations such as the OECD, the WHO or the EU. They are meant to yield a broad picture of general topics identifying the leading countries and providing a profile per country. These studies are a rich source of data for gaining an up-to-date overview about different indicators. While the scope of some of these studies is rather general, e.g. the national healthcare systems and the health status, others are more focused, e.g. covering eHealth activities. [10]

Besides multi-national, there are national and bi-national studies. In the United States the Healthcare Information and Management Systems Society (HIMSS) publishes regularly results of national IT surveys which give insight into the developments having taken place over the years. These analyses describe IT trends at a meso-level, the level of different hospitals and their characteristics in one country. [10]

In contrast, multi-national and bi-national studies on IT prevalence reveal factors influencing IT adoption that are associated with characteristics of the countries and their healthcare system (macro-level). Forces acting on this level have not been investigated extensively so far. Most of the studies on IT adoption cover healthcare providers in one country or in one region within this country (meso-level). Several factors are being discussed at this level to influence the decision whether a hospital adopts an IT system or not. Among these factors there are hospital size, system affiliation, teaching versus non-teaching hospital, ownership,location (urban vs. rural area) and IT budget and IT staff. Only system affiliation was unanimously regarded to exert an influence on IT adoption: It could be demonstrated that members of a health system or group of hospitals were more ready to implement IT systems than single hospitals. Also status as teaching hospital seems to positively influence the willingness to use IT. Hospital size and ownership (for-profit, not-for-profit, government) are discussed controversially. Some authors found large or not-for profit hospitals to have more clinical IT systems than smaller or for-profit hospitals. Yet

other studies did not find any (consistent) influence of hospital size or ownership on the prevalence of clinical IT systems. Wang and colleagues reported that more for-profit hospitals had managerial IT systems than not-for-profit hospitals. More IT staff and higher IT budgets were found to positively affect IT adoption as well as location in an urban area.[10]

IT adoption is also studied at the micro-level, i.e. within one hospital once a positive decision to purchase an IT system was made. Several theories have been proposed to understand factors leading to IT adoption. For example, the task-technology fit model describes how the three factors tasks, technology and users interact and influence user evaluation of IT systems.[10]

Market of LIS in US:

The American Laboratory Information systems market is estimated to grow at a CAGR of 7.8% from 2014 to 2019. U.S. hold larger share in the laboratory information systems market, Canadian region is expected to grow at the highest CAGR of 8.3% in the forecast period. [11]

The North American laboratory information systems market has been broadly classified on the basis of products, types, components, delivery mode, and end-users. The product segment is divided into; standalone LIS, and integrated LIS. On the basis of types the market is segmented as; clinical LIS, and anatomical LIS. The end-users segment includes; Clinical Diagnostic Laboratories, Hospitals, Anatomical Pathology Laboratories, Blood Banks, Molecular Diagnostic Laboratories Anatomical pathology laboratory is the fastest growing segment is estimated to grow at the highest CAGR from 2014 to 2019. Factors such as increasing adoption of LIS technologies in Ophthalmology, surface tissue and mucosal membrane analysis, gastrointestinal tract, and vascular system, and increasing need to shift towards integrated healthcare systems are driving the growth of this market. [11]

The following lists examples of laboratory investments describing the types of initiatives, their benefits and dependencies: [12]

Investment	Description	Benefits	Dependencies

Electronic transfer of laboratory results	Secure transfer of results to clinician who ordered tests and other interested clinicians. Initially message is at the human readable level only but later moves to automatic transfer of system-interpretable data	Quickly and more reliable availability of pathology results. Reduction in duplication of tests and unnecessary tests. Eventually electronic decision support for the ordering and interpretation of pathology tests	1. Compatible systems in laboratory and remote sites 2. Affordable, reliable wide area communications 3. Agreed messaging standards
Laboratory information system with auto-tracking	A laboratory information system (LIS) is one of the key clinical auxiliary systems. Its primary purpose is to manage the workflow of samples through the laboratory. It can enable clinician access to results	Efficient work flow in the laboratory. More timely availability of results. Distribution of results to clinicians across different sites and settings. Storage of results for later review and time trend analysis	1. Basic implementation has no dependencies other than local network, reliable power within the laboratory and staff capacity to maintain the various machine interfaces 2. Local network and interface to patient administration system to obtain patient identifier details

Section D. Aim:

To identify the major causes of the incidents occurring post implementation of LIS

Section E. Objective: To access root cause analysis to evaluate the causes for delay in laboratory procedures in LIS for US based clients

Section F. Methodology:

Study Type: Retrospective, Descriptive

Study Area: Deloitte USI, Bengaluru

Study Population: Users working in related diagnostic areas of US Hospitals that are Deloitte Clients approximately 9500 in number

Sample size:259

Collection Tool: Secondary Data

Technique: A six month retrospective study post implementation of LISwas carried out and the problems that arose were analyzed. Filtering of incidents in the form of tickets was done. The buckets were taken into consideration to analyze the actual problem. Thereby identifying the root cause of incidents over a period of 6 months (May 2014-October 2014).

Data Analysis

The data was analyzed using Microsoft Excel 2010.

Ethical Considerations:

- Data Security of Deloitte data.
- Privacy and Confidentiality was maintained

Scope: Deloitte AMS covers tickets from Inpatient and Ambulatory area. This study focuses on ticketing data related to LIS.

Section G. Discussion and Result:

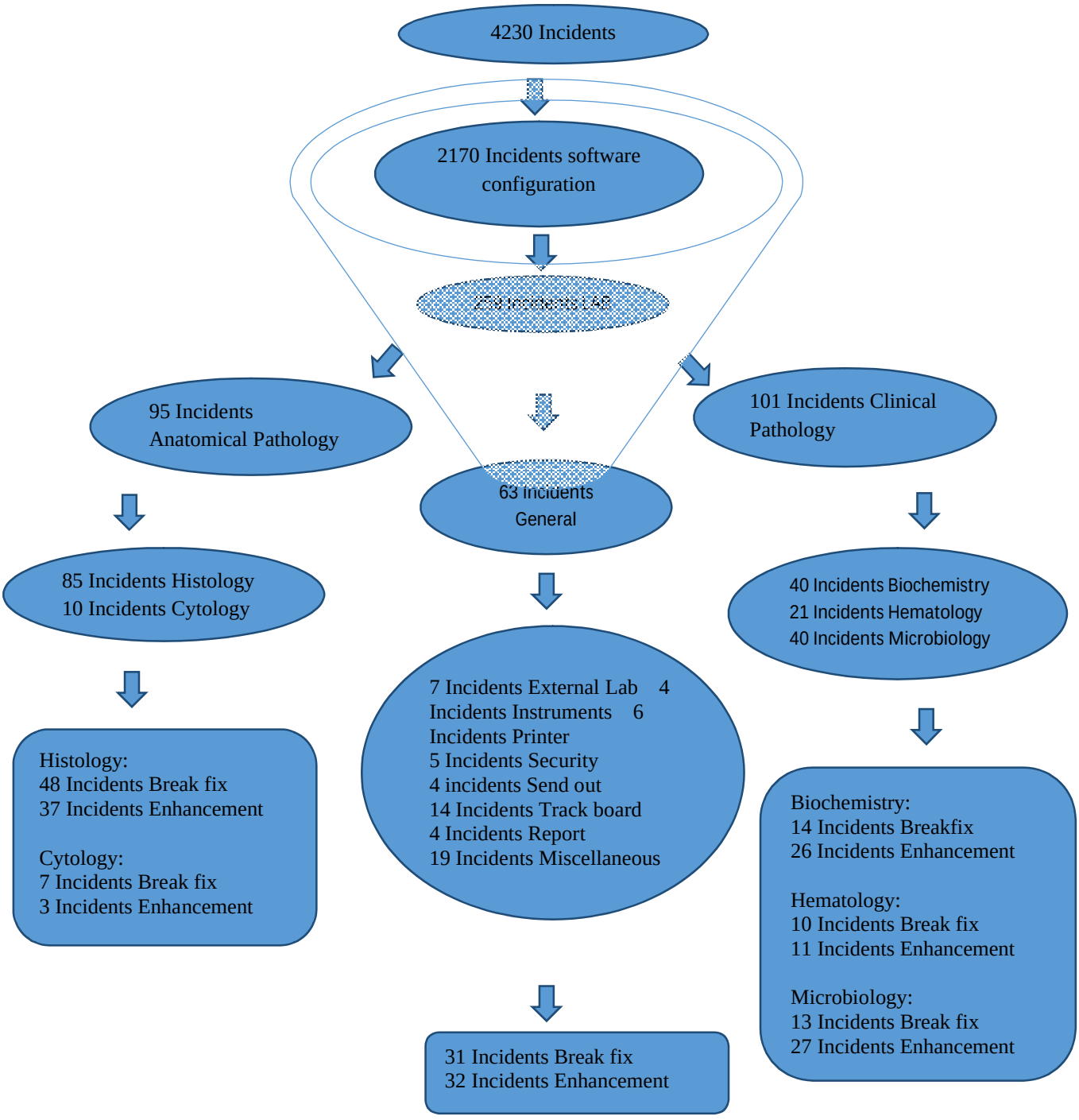


Figure 1: Summary of filtration of incidents

259 Laboratory incidents have been reported from May 2014- October 2014 and have been divided into Anatomical Pathology, Clinical Pathology and General. 95 incidents were

reported from anatomical pathology, 101 from clinical pathology and 63 incidents were general. Talking about anatomical pathology, 85 incidents were from histology and 10 incidents from cytology. In case of clinical pathology, 40 incidents were reported from biochemistry, 21 from hematology and 40 from microbiology.

A total of 4230 incidents were reported from May 2014 to October 2014 and these were categorized into the following major buckets: Communication, Hardware, Software Configuration, Training, Transfer/Update, Vendor and Uncategorized. The Number of incidents reported under each bucket and a percentage split of the same is given below:

Causes	**No of Incidents**	**%**
Communication	778	18.39%
Hardware	31	0.73%
Software Configuration	2170	51.30%
Training	575	13.59%
Transfer/Update	200	4.73%
Vendor	9	0.21%
Uncategorized	467	11.04%
Grand Total	4230	

Table 1: Categorization of causes of incidents reported

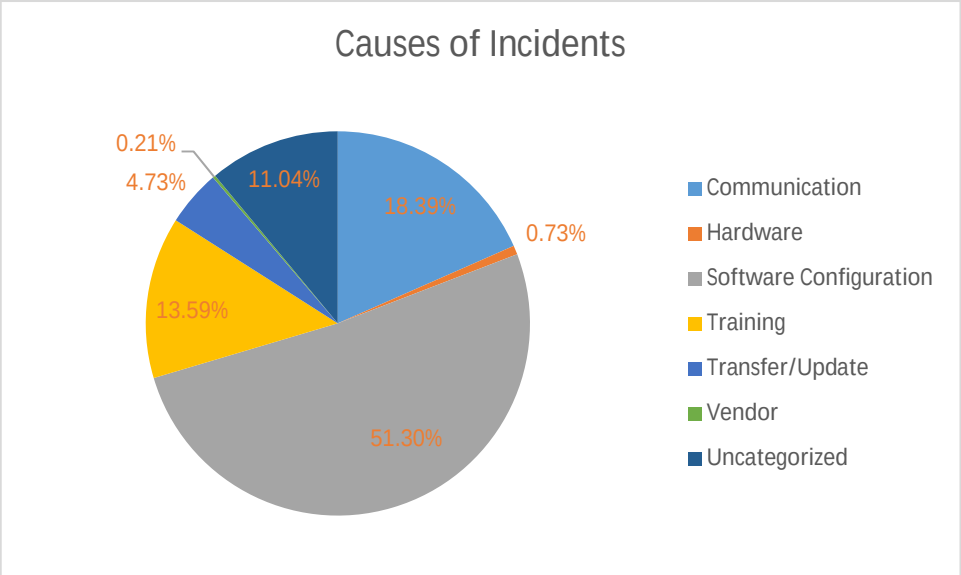


Figure 2: Main causes of incidents

As we can see the major cause of incident generation is software configuration which is 51.30%, followed by training 13.59% and communication 18.39%

In Software Configuration 48% were service request and 52% were incidents as seen below:

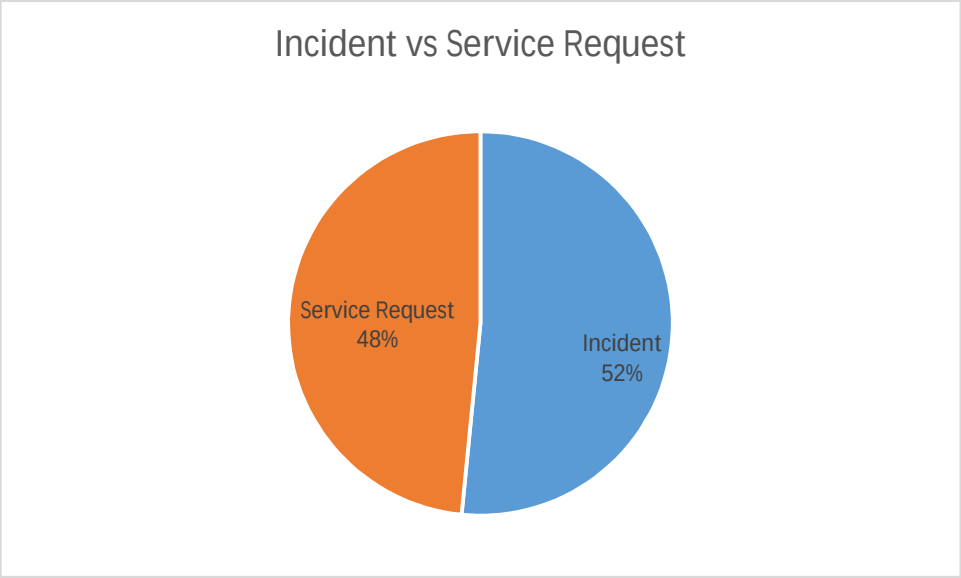


Figure3: Incidents vs Service Request in software configuration

Going ahead, in software configuration specific to laboratory, it has further been categorized into Anatomical Pathology, Clinical Pathology and General to as to understand the causes of incidents in laboratory per se.

Laboratory divisions	**Number of incidents**
AP	95
CP	101
General	63
Grand Total	**259**

Table 2: Categorization of laboratory incidents

As we can see maximum incidents arose from clinical pathology 101 in number, 39% followed by anatomical pathology 95 incidents, 37% and general were 63 incidents, 24%. This has been shown on the pie chart below for a better understanding.

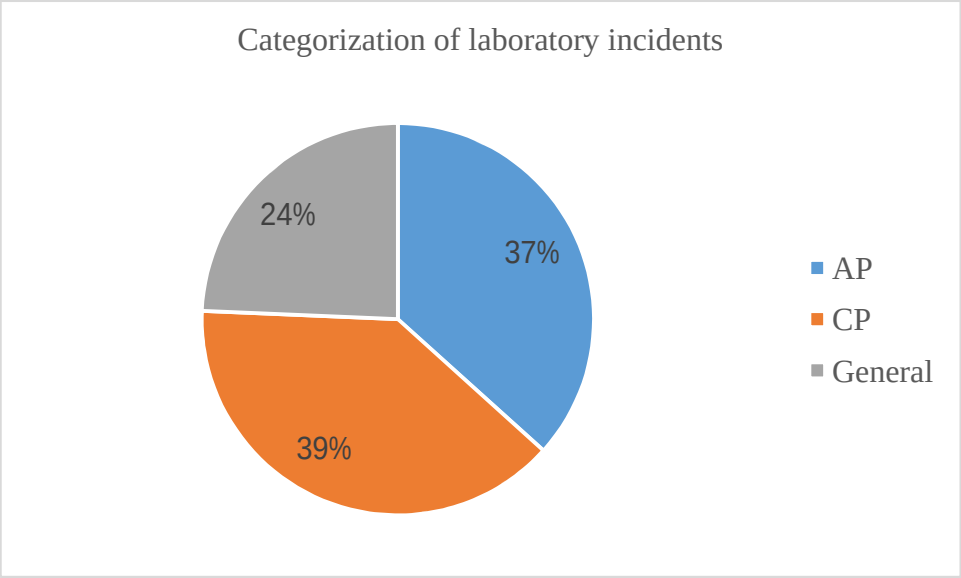


Figure 4: Categorization of laboratory incidents

As we can see incidents that arose from anatomical pathology 95 in number, to understand it further, it is categorized into cytology and histology.

AP category	**No of incidents**
Cytology	10
Histology	85
Grand Total	**95**

Table 3: Anatomical Pathology Category

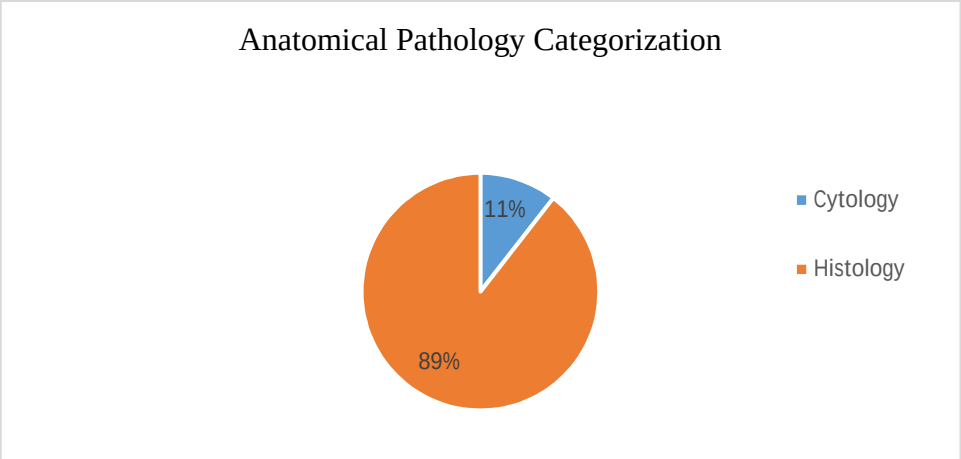


Figure 5: Anatomical Pathology category

89% incidents came from Histology and 11% from Cytology. Analyzing the incidents it was found-

Histology:
48 Incidents Break fix
37 Incidents Enhancement

Cytology:
7 Incidents Break fix
3 Incidents Enhancement

As we can see incidents that arose from clinical pathology 101 in number, to understand it further, it is categorized into biochemistry, hematology and microbiology.

CP Category	**No of incidents**
Biochemistry	40
Hematology	21
Microbiology	40
Grand Total	**101**

Table 4: Clinical Pathology Category

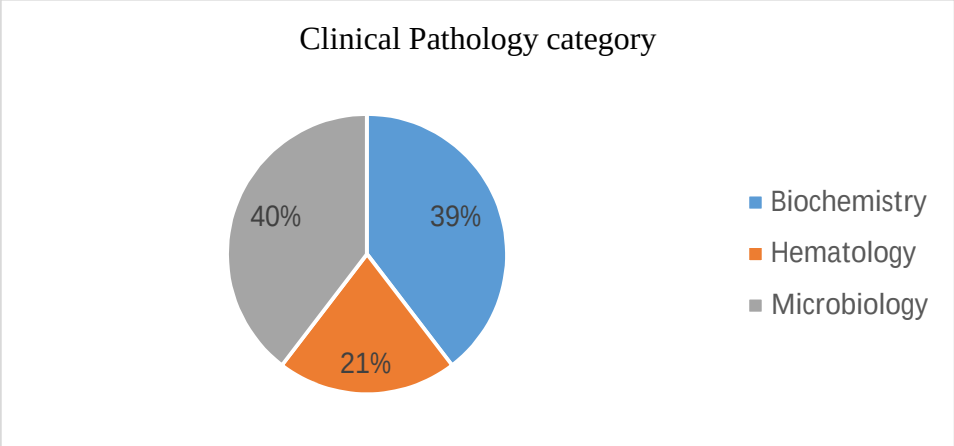


Figure 6: Clinical Pathology category

40% incidents came from Microbiology, 39% from Biochemistry and 21% from Hematology. Analyzing the incidents it was found-

Biochemistry:
14 Incidents Break fix
26 Incidents Enhancement

Hematology:
10 Incidents Break fix
11 Incidents Enhancement

Microbiology:
13 Incidents Break fix
27 Incidents Enhancement

As we can see incidents that arose from General 63 in number, to understand it further, it is categorized into:

General Category	**No of incidence**

External Lab	7
Instrument	4
Miscellaneous	19
Printer	6
Report	4
Security	5
Send out	4
Track board	14
Grand Total	**63**

Table 5: General Category

30% incidents came from Miscellaneous, 22%% from Track board and 11% from External lab. Analyzing the incidents it was found-

31 Incidents Break fix

32 Incidents Enhancement

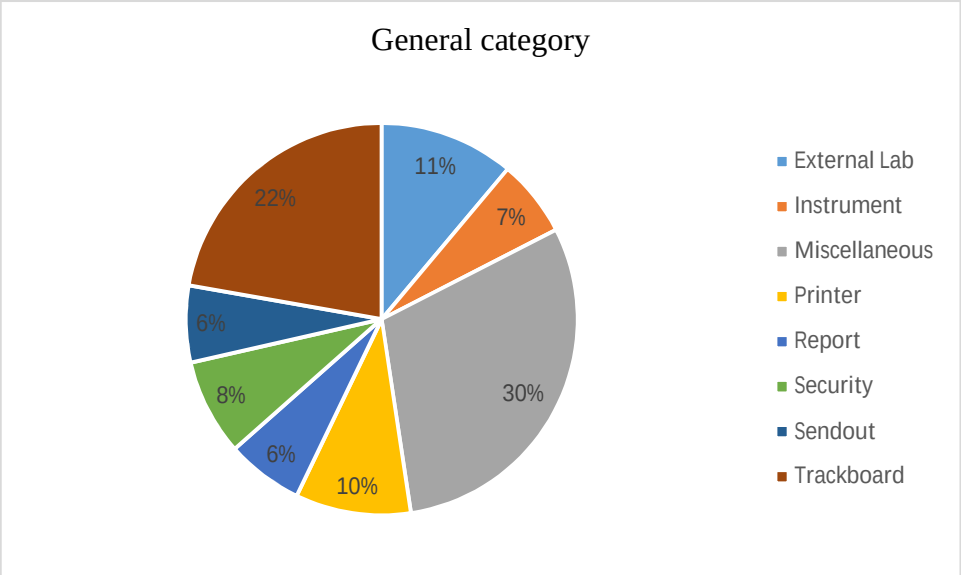


Figure 7: General category

Section F. Conclusion and Recommendation:

Common causes of Break fix seen in Laboratory were:

1) User Access: Most issues related to security/access of activities like cancellation of order, update record, or verification of order. This happens generally because role assigned to user group ormapping of security points, is wrong. Also there is change in role and it has not been properly updated. Hence it is important that the data received during import at the time of implementation is accurate and updated.

   Recommendation for Issue with user access: To avoid recurrence of these issues, an effective multidisciplinary team should be formulated who can validate the data with respect to user role and security should be followed in holistic manner. Assessing user roles, updating user role and identifying key security points for them will help reduce the number of incidence.

2) Import and configuration processcreates data inconsistency.Issues related to import and configuration process werereference range update, accession setup, antibiotic values, valid range for a test. This happens because these range are variable hospital to hospital as process, units and reagent differs for each.

   Recommendation for Issue with incorrect data:Issues related to pre implementation data has to be validated and imported properly to avoid incidents being raised. It is important to validate information and keep a regular update.

3) Interface: Issues related todata not crossing over from instrument, third party lab, hand held instrument, analyzer. This happens because data mapping thru HL7 has to be in the form of seamless integration and correct data has to be mapped.

4) Printer configuration and setup: Most of the issues related to wrong printer, workstation mapping, occurs because the team which physical setups are the workstation and printers does not communicate effectively to end user 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.

Recommendation for 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 end user, 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.Data collected from the organization in terms of number of printer, workstation and their mapping has to be concrete to avoid any nuances

Common causes of training and communication: user navigates into wrong screen, user places wrong orders, not aware of activities available in that screen, don't know how to verify the report, duplication of orders, not able to complete order, printing multiple labels, test cancelled with no proper information.

Failure to design holistic laboratory information software that addresses all users' expectations appropriately could be ascribed to poor user participation. These findings indicate that there is huge gap between LIS development and user needs. This gap arises as a result of distance between world of technical designers "hard" and "soft users" (manager and users).

The solution to this gap is the employment of project manager to foster team work and create "hybrids", those who understand both business workflow and role of information technology.

User needs failures in this study also revealed that LIS adoption in US is still in infancy. Conducting periodical evaluation; employing a comprehensive tool for LIS evaluation is crucial to ensure their effective implementation and improvement.

Evaluation of LIS must be conducted with regard to some multidimensional aspects: including user requirements, cost containment, goal achievement, etc. There is no single best way to evaluation, conducting one dimensional study relating meeting user requirements does not provide a distinct tool for selecting best LIS software. However, user- centered design account for crucial role in LIS success and its underestimation makes LIS failure inevitable.

Since, a portfolio of evolution approaches to address all aspects of hospital information system is advisable.

At the bottom line, since planning for system evaluation should be started parallel with the system design effort, following steps is recommended to ensure LIS success in health care organizations:

• Formulating a structured approach for health information selection through:

-Developing LIS selection multidisciplinary team

-Identifying critical goals

-Assessing user needs, identifying key workflows and improving processes via process improvement

mechanisms

-Providing on-site demonstration

• Incorporating HIS failures as an organization learning

• Develop a database to collect factors affecting the LIS failures; evaluating LIS and present organizations with best practices

• Appeal to knowledge management tools including community of practice (COP), sharing alliance and working with experts and coaches to ensure LIS success.

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