

**HMIS - Usage and satisfaction study among healthcare
workers through
EUCS model in Bansal Hospital Bhopal
(End User Computing Satisfaction Model)**

Dissertation Submitted to



The IIHMR University, Jaipur

2021-23

**For the partial fulfilment for the award of the degree of
Master of Business Administration (MBA)**

in

Hospital and Health Management

by

Ruchi Verma

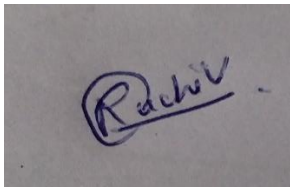
Roll No. -1376

Under the Supervision and Guidance of

**Dr. Piyusha Majumdar
(Assistant Professor)**

DECLARATION BY STUDENT

I hereby declare that this dissertation titled “HMIS- Usage and satisfaction study among healthcare workers through EUCS model in Bansal Hospital Bhopal.” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.



Name of Student: Ruchi Verma

Date: 22.05.2023

INTERNSHIP COMPLETION CERTIFICATE

BANSAL HOSPITAL

Shahpura, Bhopal (M.P.) - 462016
www.bansalhospital.com



बंसल अस्पताल

शाहपुरा, भोपाल (म.प्र.) - 462016
www.bansalhospital.com
BH/BLP/058

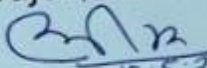
CERTIFICATE

This is to certify that **Ms. Ruchi Verma, D/O Mr. Satish Kumar Verma** has undergone a three-month training in **Operations Dept. of Bansal Super Speciality Hospital (NABH Certified) Bhopal** from **22/02/2023 to 21/05/2023**.

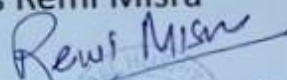
She has successfully completed her dissertation thesis named **"HMIS – Usage and Satisfaction Study among health care workers through EUCS Model"** in Bansal Hospital Bhopal.

During her training we found that she was sincere, reliable, trustworthy, and can work in a team with confidence. She also has a strong drive and zeal for learning.
We wish her all the success in her life and career.

DR Brajendra Mishra


10.5.23
Medical Superintendent
BANSAL HOSPITAL
BHOVAL (M.P.)
BANSAL HOSPITAL BHOPAL

Ms Remi Misra


HOD, Health checkup Dept.

BANSAL HOSPITAL BHOPAL

Appendix F: Certificate from Faculty Guide and School Dean

CERTIFICATE

This is to certify that dissertation titled “HMIS- Usage and satisfaction study among healthcare workers through EUCS (End User Computing Satisfaction) model in Bansal Hospital Bhopal” is a record of the research work undertaken by Ruchi Verma in the partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management) from IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide

IIHMR University, Jaipur

Date:

College Dean

IIHMR University, Jaipur

Date:

Acknowledgment

First and the foremost, I am grateful to Indian Institute for Healthcare Management & Research (IIHMR University, Jaipur) and Intern Placement Office for successfully arranging the Dissertation program for the students and giving me an opportunity to work at Bansal Hospital Bhopal as an intern and creating such a wonderful environment for learning.

The dissertation project, helped me in providing with both, a learning experience as well as a glimpse into the daily managerial level issues of this renowned hospital. I was fortunate enough to interact with their support and patience.

I would like to thank Mrs. Manisha Shrivastava (HR department) for providing me an opportunity to carry out my dissertation at Bansal Hospital, Bhopal. I want to express my gratitude and sincere thanks to my mentor Mrs. Remi Mishra (HOD, Health Checkup department) for her constant support and invaluable time-to-time guidance and help in the completion of this project.

Finally, I acknowledge my indebtedness to the staff of the Hospital for the support by guiding me throughout my dissertation period. My sincere gratitude to Dr. Mahendra Kumar (Professor Dean, IIHMR, Jaipur) for his relentless support and guidance.

My regards goes to my guide at the institute, Dr. Piyusha Majumdar (Assistant Professor) for her very helpful attitude and valuable suggestions. I would like to express my heartfelt thanks to my parents for their moral support, which had always inspired me to perform my best. And finally, credit goes to all my friends and colleagues who helped me in this study.

Sincerely,

Ruchi Verma

MBA-HM 26

ABSTRACT

HMIS – Usage and satisfaction study among healthcare workers through EUCS model in Bansal Hospital Bhopal

Submitted By: Ruchi Verma
MBA HM 26, ROLL NO:1376
Guided By: Dr. Piyusha Majumdar
(Assistant Professor)

i) INTRODUCTION

The pace of technological advancement is astounding. Humans' growing desire for technology is the foundation for technological advancement. These technologies have advanced throughout all facets of human life, not just one particular field. One area of technology that is evolving quickly is technology for information and communication. Information technology and communication both do have an indisputable impact in the current decade on business and government sectors. Talking about human existence and information demands, they both are intertwined; both individuals who receive information and those who offers exist. Sending or sharing information takes place digitally during current times. Software programmes on a frequent basis serve as a crucial medium for both transmitting and storing information.

Hospital Management Information System (HMIS) is a comprehensive software solution designed in order to manage the day-to-day operations and administrative tasks in a hospital. The system unifies a number of tasks and procedures, which includes inventory management, patient registration, admission, billing, appointment scheduling, and more. HMIS is a very important instrument that can efficiently assist hospitals in increasing their productivity, cutting expenses, and improving patient care. HMIS adoption in hospitals has greatly increased in recent years(1). The key causes of it are increasing need for high-quality healthcare services, escalating rivalry, and the obligation to adhere to regulatory standards. Utilising HMIS enables hospitals not only to improve operational efficiency but also to lower error rates, and give healthcare executives and physicians rapid access to reliable information.(2)

The thesis investigates and includes the use and satisfaction levels of hospital management information systems (HMIS). A software programme aids in the management of patient data, medical records, and other information pertaining to healthcare which is basically HMIS.

The intention of the study is to look into how much the HMIS is used in the hospital under study, what influences on how it is utilised, and the satisfaction of the hospital staff with the functionalities of the system. The thesis is also aimed at pinpointing any difficulties developed throughout the application and use of HMIS. HMIS can (has potential) increment system in its efficiency via automating process and produce reports of vital importance for

the management of quality, planning, decision-making, operations, performance, and projects reporting. There should be the awareness that merely providing HMIS will may not cause all the change that we hope for; instead, it should be properly planned, executed, used, and continuously enhanced.

Therefore, it is necessary to evaluate the satisfaction among healthcare workers in the hospital with the HMIS current performance. That is systematically done in the thesis with the use of EUCS model, that is, **End-User Computing Satisfaction Model. (3)**

End-user computing satisfaction (EUCS) can be explained as the entire emotive and cognitive appraisal of the (healthcare worker or patient) end-user's enjoyment of the HMIS consumption-related fulfilment.(3)

The **EUCS model** was initially or firstly developed by Doll & Torzadeh in the year 1998 (3). It focusses on ultimate user satisfaction alongside technological component through access of 5 dimensions including a) content b) accuracy c) format d) timeliness d) ease-of-use of the system (15). EUCS method is used for evaluating the satisfaction zone of users of the system mainly by comparison of expectations or presumptions and actuality of an (IS) information system for the determination of whether the IS or information system in use is actually efficient.

ii) RESEARCH OBJECTIVES

Broad- Study on usage and satisfaction with HMIS among healthcare workers in Bansal Hospital Bhopal.

Specific- a) To access HMIS implementation process in the hospital.

b) To explore HMIS usage in different departments of the hospital.

c) To analyse HMIS satisfaction level among healthcare workers in the hospital.

iii) METHODOLOGY

Study type- The particular study is prospective and observational in nature.

Study area and period- The particular study had taken place for a period of 3 months duration in Bansal Hospital Bhopal.

Sample size- Sample containing 110 survey reports was picked out for the study.

Sampling method-

- A) Study used purposive sampling for the collection of data in order to analyse the HMIS adoption rate, HMIS satisfaction and HMIS utilization among the healthcare workers. (4)
- B) Closed ended study had been done.

Data collection technique-

- A) Collection of primary data from 110 respondents was done via questionnaire prepared in Google forms for the evaluation of satisfaction level. (4)
- B) Direct observations and personal interviews with workers – For the collection of data from participants for analysis of HMIS usage. The investigator was involved in the setting at each site, acting or appearing as an (ethnographic approach) unobtrusive observer.

Data analysis-

- A) Analysis of data - Via MS Excel / Graphical analysis – with the help of bar graphs and pie charts.
- B) (EUCS) End User Computing Satisfaction Model – for the purpose of data analysis and satisfaction evaluation.

Inclusion and exclusion criteria-

Inclusion criteria- Only HMIS using hospital staff responses were included in the study

Exclusion criteria- Other clinical staff (including doctors) were excluded from the study.

iv) FINDINGS/ RESULTS

1. Demographics: 42% of the respondents were Male , 58% were Female. 47% were of the age group between 20-25 years, 41% were between the age group of 25-30 years, 12% were of the age group greater than 30 years.

2. Impact of HMIS: According to the healthcare workers HMIS had improved clinical decision-making in the management of patients and improved collaboration between healthcare professionals involved in patient care, which had increased overall productivity in HMIS on healthcare delivery. Additionally, it was said to have improved the standard of patient care at HMIS. All of these incremented patient and healthcare provider satisfaction.

3. HMIS Satisfaction: The results that were concluded in the study included that Content (A1), Accuracy (A2), Format (A3), Ease of use (A4), & Timeliness (A5) were in a fairly good and good category, with an approximate percentage or values of

69.05%, 66.90%, 72.0%, 66.70%, and 77.30%. The study results or answers also depicted based on descriptive analysis results, talking about variable that was dependent, that was, User Satisfaction (B) on HMIS as per each question was in the Good category having an approximate value of 70.4%.

v) **CONCLUSION :**

The findings or the conclusion of the study contributed basically to the understanding of HMIS implementation and usage in a hospital setting, and the EUCS model's applicability in assessing users' satisfaction with the system, provides insights into the effectiveness of HMIS in enhancing the quality of hospital services and patient outcomes through –

- 1) Improved employee retention.
- 2) Increased efficiency and productivity
- 3) Improved patient care
- 4) Cost savings
- 5) Gaining competitive advantage over other hospitals

The study also gave the contribution to the existing or current body of knowledge on the implementation & healthcare information systems adoption in hospitals. The results of the study might be used to inform policymakers and healthcare administrators on the appropriate measures to take to enhance the adoption and usage of HMIS in hospitals.

vi) **KEY WORDS :** HMIS, EUCS model, user satisfaction, cross sectional study, five attributes, improving quality of hospital services

TABLE OF CONTENTS

1) About the organisation.....	11
2) Background.....	13
- Introduction.....	13
- Rationale.....	14
- Research question.....	15
- Objective.....	15
3) Review of literature.....	15
✓ HMIS implementation and its stages.....	19
✓ HMIS usage in hospital.....	21
✓ HMIS satisfaction evaluation through EUCS model.....	25
4) Materials and methods.....	35
- Study type.....	34
- Study area.....	34
- Study period.....	34
- Study respondents.....	34
- Sample size.....	35
- Sample method.....	35
- Data collection technique.....	31
- Data analysis method.....	35
- Ethical considerations.....	37
- Inclusion criteria.....	37
- Exclusion criteria.....	37
5) Data analysis.....	38
- Demographics (Gender, Age).....	38
- Compliance of using HMIS.....	40
- Time period of HMIS usage.....	40
- Purpose of HMIS/ HMIS Usage.....	41
- Issues faced with HMIS.....	42
- Frequency of issues faced.....	43
- Awareness about HMIS.....	44
- Confidentiality maintenance with HMIS.....	44
- Descriptive analysis.....	45
6) Results and Discussion.....	52
7) Limitation and recommendations.....	54
8) Conclusion.....	55
9) Supplementary.....	56
- Annexure	
- Questionnaire	
10) References.....	61

HMIS – Usage and satisfaction study through EUCS model in Bansal Hospital Bhopal

1) ABOUT THE ORGANISATION

HMIS of Bansal hospital is provided by (outsourced to) Practo HLS.

Practo HLS (Healthcare Logistics Services) is a division of Practo Technologies Pvt. Ltd, which provides technology enabled healthcare logistic services in India.

Practo is a technology company that provides a variety of healthcare services, including Hospital Management Information System (HMIS) services, to hospitals and other healthcare providers. Hospitals may manage every area of their business with the use of the Practo HMIS, including patient management, clinical workflows, inventory control, and billing.(5)

As Practo HMIS is a cloud-based solution, it allows hospitals to access their information, data and software from any site or location with an internet connection, which is considered as one of its main advantages. This helps in remote management of operations for healthcare workers and professionals. This can prove to be useful in emergency situations or when professionals or workers are working virtually.

There is a lot of customization options in Practo HMIS. Hospitals can opt from modules variation in order to build a solution that addresses their needs specifically. Also their needs develops and grows over time, addition or deletion of components can be done. Scalable design of system is also done, that tells that as the hospital expands its operations it can also grow.

In we talk about its features, a wide range of functionalities is offered by the Practo HMIS , including appointment scheduling, patient management, electronic medical records (EMRs), pharmacy management, clinical workflows, inventory management, , and analytics and reporting, billing and invoicing. Design of the system is such that so as to streamline operations and increment efficiency, which has the potential to lead to better patient outcomes and higher patient satisfaction levels.

Altogether, Practo HMIS is a robust and extremely customizable solution for hospitals which are looking to more efficiently manage their operations (5).The cloud-based architecture, wide range of features, and scalability makes it great option for healthcare providers or workers who were wishing for streamlining their operations and for improving the patient care quality.

Bansal Hospital is a renowned multi-specialty hospital located in Bhopal, Madhya Pradesh, India. It was established in 2002 and since then has grown to become a prominent healthcare institution in the region. Bansal Hospital is spoken for its state-of-

the-art facilities, advanced medical technologies, along with highly qualified medical professionals.(6)

The hospital provides a wide range of quality medical services, including:

- Neurology
- Orthopedics
- Cardiology
- Gastroenterology
- Urology
- Endocrinology
- Nephrology
- Dermatology
- Ophthalmology
- Pulmonology
- ENT
- Oncology
- Paediatrics
- Obstetrics and Gynaecology
- General Surgery
- Plastic Surgery

Alongside above services, Bansal Hospital also provides patients with specialized services in the hospital including 24-hour ER department, critical care unit, diagnostic services and rehabilitation services.(6)

In Bansal Hospital, Hospital Management Information System (HMIS) is used to manage patient data and medical records. HMIS being an integrated system includes various modules for example, patient registration, electronic medical records, laboratory information system, appointment scheduling, pharmacy management, and billing. Conclusively, HMIS is designed for making operations in the hospital efficient and effective, to give timely accessibility to accurate patient information/ details to medical professionals and thus enhancing patient safety. Overall, Bansal Hospital is a leading healthcare provider in the region, offering high-quality medical care and advanced services to patients.

2) BACKGROUND

2.1 HMIS INTRODUCTION

A hospital management information system (HMIS) is a platform of IS or information system that was developed & created particularly to aid the planning and management of hospital functions in opposition to service delivery (1). A comprehensive and integrated information system is referred to as a "HMIS" which is meant to handle all aspects of business of hospital, which are i) medical, ii) administrative, iii) financial, and iv) legal concerns (7). The two types of hospital information systems are integrated and modular. The four categories into which integrated IS are classified into 1) hospital general information systems, 2) clinical information systems, 3) management information systems, and 4) database management systems.

In resource-constrained and developing nations like India, replacing paper-based IS or information systems trend with hospital's HMIS is frequently catching the trend up. Recent research as well as emerging trends make it clear that HMIS is absolutely necessary for the creation and analysis of hospital data.(8) On a more limited scale, it offers the specific hospital setting an unbeatable cost-effectiveness, by enabling effective intra-institutional correspondence via command chain, improved stakeholders communication, materials supply in a timely manner, in-house as well as inter-institutional data or information shifts to staff in healthcare, finally improving hospital efficacy and effectiveness in terms of both time & cost. (15)

It improves the effectiveness of the healthcare system as a whole from a larger perspective. It provides excellent chances for the creation of baseline statistics at both the local and a national level, opens up new areas for health and healthcare research, and finally helps to advance the practise of evidence-based medicine.(10)

HMIS is a technique instrument used to manage the patient caring operations of hospitals by the automation of transactions, capturing necessary info, and creating wealthy insights.(10) Appropriate development & planning of a solid grasp of the features and needs of the system will aid in the objective evaluation and implementation of the best system. Routine monitoring through data developed by the system would aid continual progress in the IS system (information).(9)

Above all, HMIS guarantees hassle-free, thorough, unbiased, and accurate data collection.

Using an HMIS system, authorised doctors and staff within a healthcare organisation can create, assemble, manage, and examine an electronic record of a patient's health-related data. They may provide doctors, clinics, and healthcare organisations with important benefits.(10) It is straightforward to navigate the patient's medical history

thanks to an EMR maintained in HMIS. Digital health records are accessible to several healthcare experts at multiple sites.

This could be helpful when greater than two doctors are required for patient's case access. Also, an HMIS provides clinical support by notifications sending and reminders of appointment to doctors as well as patients.

Only if time could be reversed, the seeds have been sown of what we see above. According to a study of recent time, done by healthcare solutions vendor Indigene, almost 60% Indian doctors interact with patients and meet with medical reps using digital communication tools like video chats, apps, emails, text messages, and more.

At Bansal Hospitals, HMIS was developed and implemented first time in the year 2014. The particular system was in continuous review, updation and expansion with the new features as required and opportunities actually arose for automating & improving it.

HMIS usage and the data or info that it gave helped Bansal Hospitals immensely on all the fortes including – efficiency, quality, compliance, demand, etc.

ISSUES ARISING-

Many issues and obstacles crop up at every stage, from planning to implementing, monitoring to quality assurance, which results in a subpar HMIS deployment. Some of these include poor planning and financing, resource mismanagement, inadequate monitoring as well as supervision, skill development issues, very poor data quality, and an absence of dedication and leadership.

2.2 RATIONALE

Technologies adoption faces a variety of difficulties that necessitate micro level research in order to comprehend the problems and implement solutions. A thorough strategy is required at this time since the use of HMIS encompasses both human and material (technological) components.

HMIS system is being used in Bansal Hospital to run the hospital and provide healthcare, so it is important to assess its impact and comprehend the difficulties associated with its adoption, usage and satisfaction. The study's goal is to ascertain how HMIS affects Bansal Hospital's healthcare services. Among healthcare professionals, a cross-sectional qualitative study will be conducted.

2.3 RESEARCH QUESTION

What is the HMIS usage and the satisfaction level among the healthcare workers of Bansal Hospital, Bhopal?

2.4 OBJECTIVE

Broad- Study on usage and satisfaction analysis of HMIS among healthcare workers in Bansal Hospital Bhopal.

Specific- a) To access HMIS implementation process in the hospital.

b) To explore HMIS usage in different departments of the hospital.

c) To analyse HMIS satisfaction level among healthcare workers in the hospital.

3) REVIEW OF LITERATURE

i) Hospital information systems: Measuring end user computing satisfaction (EUCS).

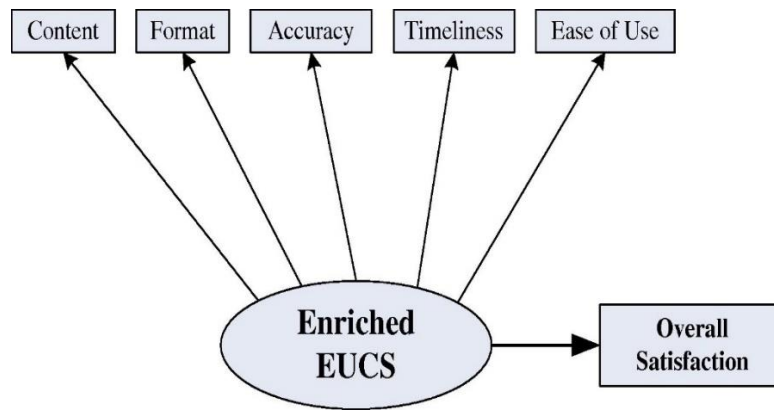
<https://www.sciencedirect.com/science/article/pii/S1532046412000391>

End User computing Satisfaction - The degree to which users are satisfied with their overall experience when utilising an information system is referred to as satisfaction. The effectiveness and conformity of the information system in use were evaluated by measuring the experience.

In 1998, Doll and Torkzadeh created the EUCS evaluation paradigm. By evaluating the system's content, correctness, timeliness, and usability, this approach places an emphasis on end-user satisfaction with technological features.

By contrasting users' presumptions and the actual performance of an IS, EUCS is a technique for determining how satisfied users are with an application system.

The effectiveness of the information system being used and its alignment with desired outcomes are assessed by measuring the user experience.



ii) HIMIS acceptance level of among the nursing officials who are working in a teaching hospital.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8826790/>

The study was addressed at accessing the HMIS acceptance level among nursing officials who were working in a teaching hospital.

A cross sectional study for 1 year was performed by using a pretested questionnaire in the sample size of 256 nurses.

Purposive sampling done with the participants in the study including nursing officers (NOs) those were not under any particular probation period.

Observations of the study included that most of the participants were aware of HMIS and almost half of the respondents had good HMIS acceptability. The acceptance level was found out to be good among nursing officials. Results indicated that 67.96% of participants had good HMIS system acceptability.

Reason behind this appreciable acceptability was concluded to be-

- The job description of respondents
- Distribution of places of their work
- Respondents' history with HMIS

Interventions concluded were- The hospital management can solve the bottlenecks with the right solutions, such as error prevention, connectivity issues, and absence of training.

iii) Usage of End-User Computing Satisfaction (EUCS) Method for Testing User Satisfaction in Hospital Management Information System (SIMRS) (Case Study at the Regional Public Hospital Dr. A. Dadi Tjokrodipo)

<file:///C:/Users/Hp%20Pavilion/Downloads/Thesis%20in%20process/sample%20thesis%204%20imp.pdf>

Aim- To assess the satisfaction level of users via EUCS method of HMIS at location, Regional Public Hospital by Dr. A. Dadi Tjokrodipo for obtaining a brief of the user satisfaction point as a benchmark for subsequent evaluations as well as investigate the factors that affect user satisfaction.

Sampling technique- Purposive sampling was used as the sample strategy in this investigation.

Methodology- EUCS model used as data analysis method. a) Content, b) Accuracy, c) Format, d) Ease of Use, e) Timeliness, and f) User Satisfaction are the factors used in this thesis. The Likert Scale was utilised as a variable measuring scale in the study.

Result- The categories of a) Content, b) Accuracy, c) Format, d) Ease of Use, and e) Timeliness scored on average 55.67%, 60.27%, 62.50%, 64.83%, and 66.17% respectively.

The study's findings also showed that, according to each question's average value of 71.33%, the variable f) User Satisfaction on the hospital management information system fell into the Good group.

iv) **Utilization of Hospital Management Information System (HMIS) in an effective manner (Aravind eye case)**

<https://www.iapb.org/news/effective-utilization-of-hospital-management-information-system-hmis/>

The Hospital Management Information System is a complete information system outfitted to handle all aspect of the hospital's management. Utilising information technology is essential for hospitals. The Hospital Information System (HIS) is a data processing method based on information technology and combined with manual procedures and other procedures to provide timely and accurate information to support management decision-making processes in hospitals. The management information system is currently the most important resource. This system is strategic and essential to the Hospital's ability to provide the best services.

HMIS is used in hospitals to oversee patient care and related administrative duties. The system's total efficiency may be improved by automation, which also generates the essential reports for managing project operations, performance, quality, planning, and reporting. It is important to remember that merely implementing HMIS won't bring about all the desired changes; instead, it must be carefully created, implemented, and then continuously improved.

There are seven stages of HMIS implementation, which includes;

1. Stage of planning
2. Stage of analysis
3. Stage of design and prototyping
4. Stage of development
5. Stage of testing
6. Stage of implementation and integration
7. Stage of maintenance

Challenges faced while HMIS implementation process in Arvind eye care-

- Aligning to workflow
- Unclear expectation
- Incomplete or wrong data
- Online system (on contradiction to offline system)

v) ESIC Healthcare Professionals in Tamil Nadu adoption of HMIS : An Integrated Model

<file:///C:/Users/Hp%20Pavilion/Downloads/ojsadmin,+98.pdf>

Processes for managing information had tremendously aided in the production, dissemination, and application of knowledge. Additionally, they assisted in addressing upcoming challenges related to efficiency, patient demand and need growth, and staff resource shortages.

The sub-classification under "usage of management information system", were 1) system quality, 2) information quality, 3) use 4) user satisfaction & development. The human resources management made the most use of the information that was generated.

Research Issue: Numerous hurdles existed in the context of technological progress and application, and these challenges called for micro level research to both comprehend the problems and find workable solutions. New system deployment in the Indian reality involves both human and material (technological) components, hence a holistic approach was urgently needed. More often than not, health care services focus on a person's emotional needs.

As a result, an appropriate framework must be created and used by including the necessary variables and parameters for the evaluation of information system satisfaction.

HMIS IMPLEMENTATION AND ITS STAGES

In Bansal Hospital Bhopal, HMIS was implemented in August 2013 and it went live on February 2014.

7 Main Stages of the (SDLC) System Development Life Cycle

Generally, it includes 7 primary stages for the modern System Development Life Cycle (SDLC) (11,12), which includes;

1. Stage of Planning
2. Stage of Feasibility or Requirements for analysis
3. Stage of Design and Prototyping
4. Stage of Software Development
5. Stage of Software Testing
6. Stage of Implementation and Integration
7. Stage of Operations and Maintenance

Here, in Bansal Hospital the phases of implementation of HMIS were as follows;

- 1) **Planning Phase:** Referring to the particular phase, the hospital management identified the need for an HMIS and dealt with the planning of implementation. Then the scope, objectives, and expected outcomes of HMIS implementation were defined. The phase included the choice of an HMIS vendor, budget allocation, and resource planning.
- 2) **Analysis Phase:** The hospital's existing processes, workflow, and information systems were assessed in the analysis phase. Interview of the hospital staff to understand their requirements and pain points took place. It helped in identifying the gaps in the existing system and it did determine the HMIS functionality requirement.

- 3) **Design Phase:** On the basis of requirements gathered in the analysis phase, the HMIS was designed in this phase. It included the development of a user interface design, detailed system architecture, application design, and database design.
- 4) **Development Phase:** This phase involved the HMIS software actual coding . The software development team during the development phase, created the necessary modules, integrations, and functionality on the basis of design specifications. It also included unit testing and debugging of the software.
- 5) **Testing Phase:** This particular phase involved, the HMIS testing for its functionality, usability, performance, and security. It was led by a dedicated testing team and that included both manual and automated testing methods. It mainly helped in identification and fixation of any defects or issues in the HMIS.
- 6) **Training Phase:** Hospital staff was needed to be trained on how to use the HMIS, before rolling out of HMIS . For that purpose, the software vendor provided training to the hospital staff on the clarity of how to use the new system much effectively.
- 7) **Deployment and Go-live Phase:** As soon as the HMIS system was tested and staff were trained, rolling out of HMIS was done in the hospital. The support during the initial rollout period to ensure that any issues that arose were quickly addressed by the software vendor. Specifically, deployment phase did involve the configuration and installation of the HMIS in the hospital's IT infrastructure.

It took place in the month of February of the year 2014 in this hospital. That is HMIS software was rolled out to the hospital staff, and data was migrated from the old system to the new HMIS system.
- 8) **Maintenance Phase:** The ongoing support and maintenance of the HMIS was involved in the maintenance phase. Technical support and updates to the software to ensure that HMIS remained functional and secure was provided by the HMIS vendor. It included the following aspects- debugging and updating if new risks were identified so that they had to be included in the system modules.

It involved periodic assessments of the system's performance leading to user satisfaction.

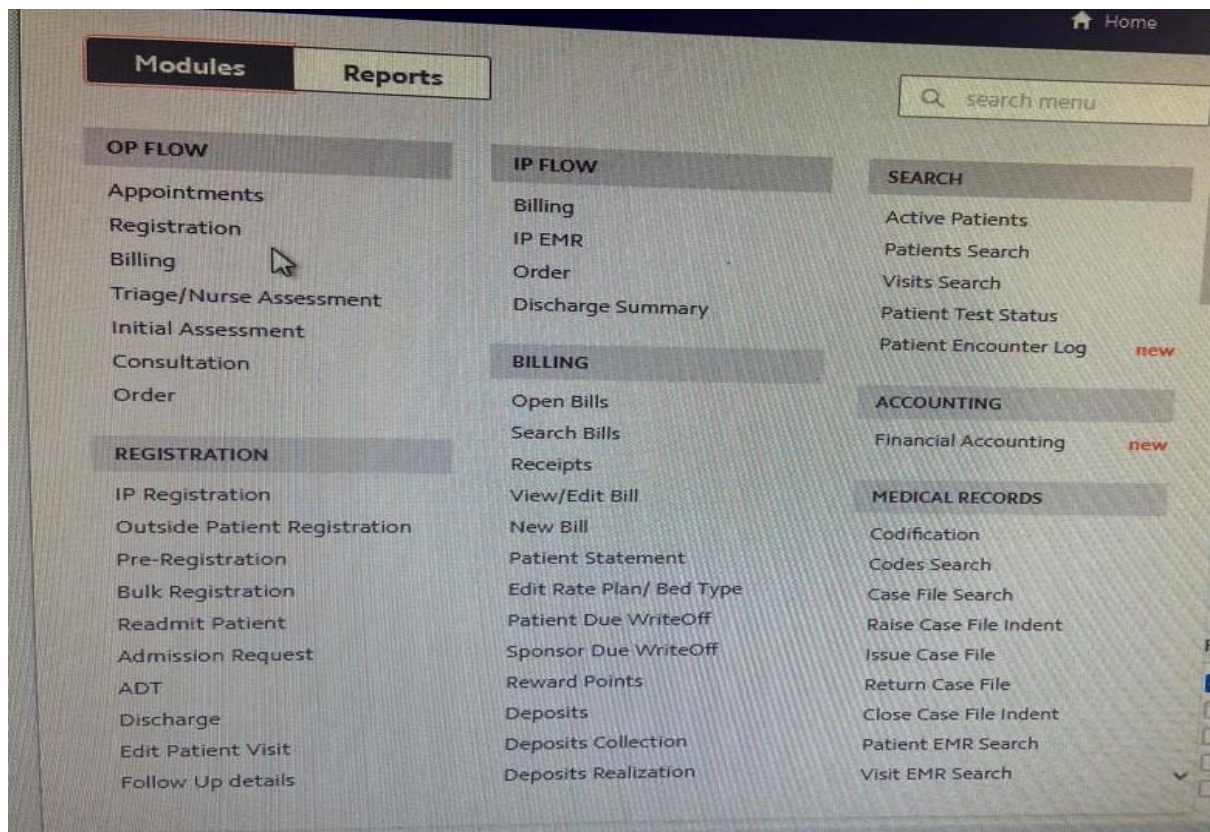
USAGE IN DIFFERENT DEPARTMENTS

HMIS Usage

It was widely believed that the HMIS usage in Bansal hospital provides huge development prospects as well as opportunities, mainly in patient care quality improvements , enhanced staff efficiency as well as effectiveness, and a significant decline in its operational expenditure.

There were in total 21 modules of HMIS in the hospital which were effective. All 21 modules and their components are illustrated below along with their pictures from the system-

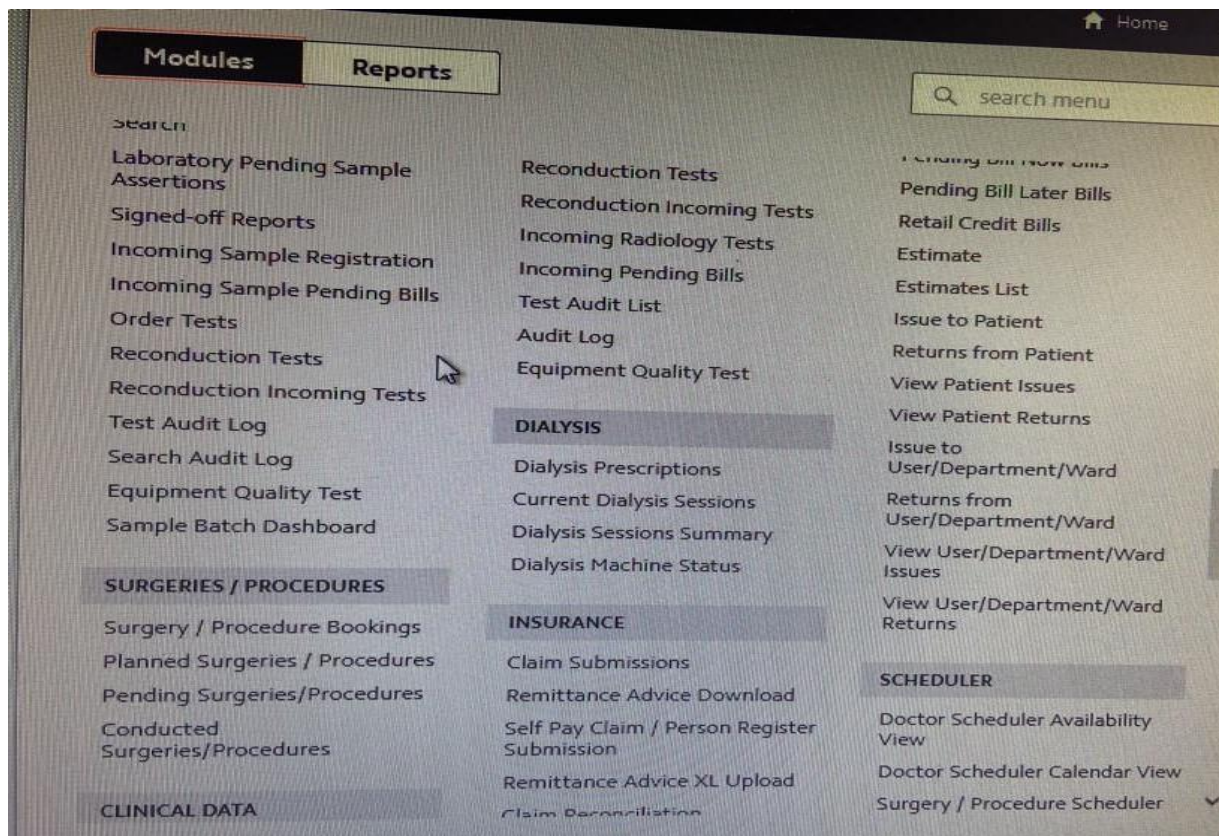
1. OP flow
2. Registration
3. IP flow
4. Billing
5. Search
6. Medical records
7. Payments
8. Laboratory
9. Patient
10. Radiology
11. Services
12. IVF
13. Sales/ Issues
14. Surgeries/ Procedures
15. Clinical data
16. Insurance
17. Scheduler
18. Procurement
19. Maint and contracts
20. Store management
21. CSSD



MODULES IN THE SYSTEM (image 1)



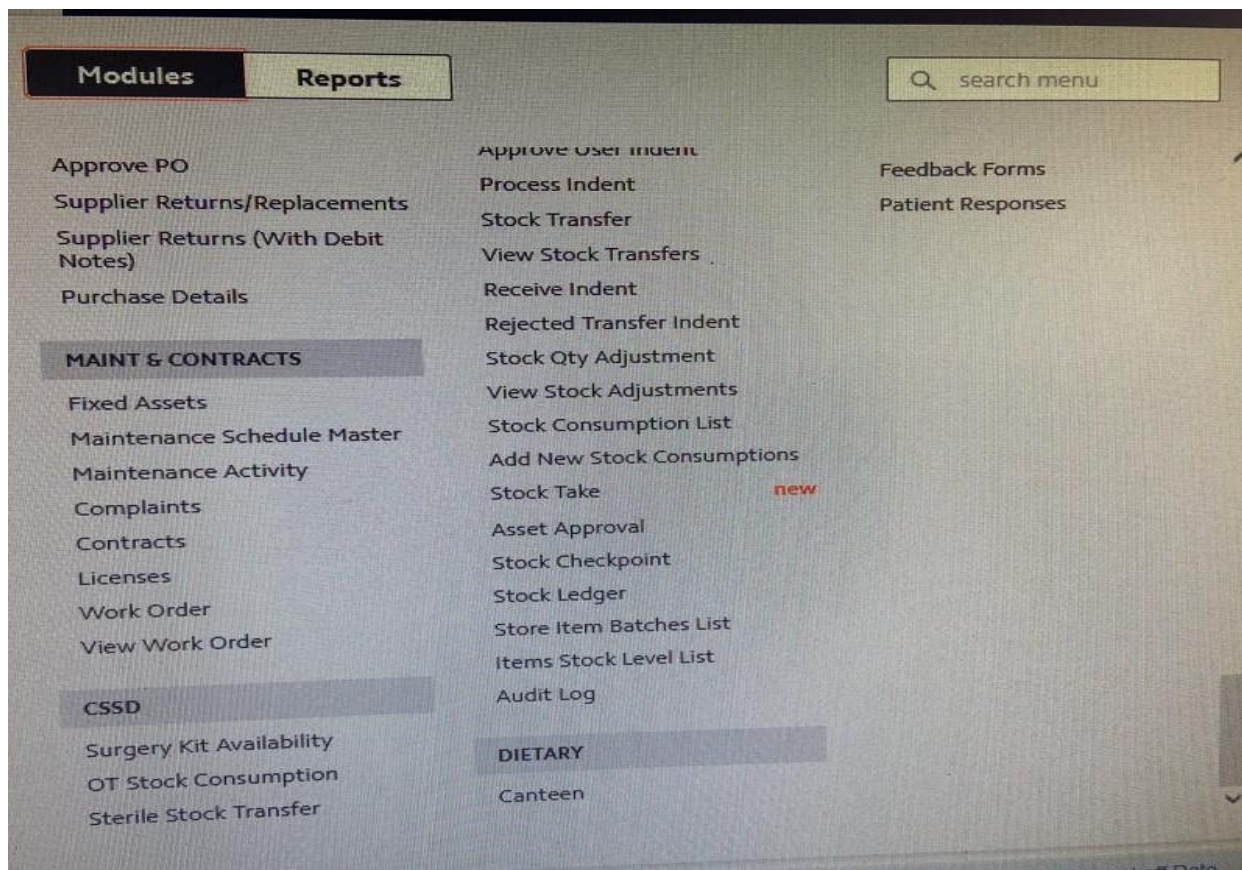
MODULES IN THE SYSTEM (image 2)



MODULES IN THE SYSTEM (image 3)



MODULES IN THE SYSTEM (image 4)



MODULES IN THE SYSTEM (image 5)

HMIS in Bansal hospital used was **Practo HLS**.

HMIS consisted of various applications which consisted of both in house as well as outsourced applications which plays their specific roles in the running of different departments of the hospitals.

When it comes to IT, the word "outsourcing" means the services supply system, functions or specifications from an external source, that is typically that one who supplies the software & hardware. Additionally, the word "outsourcing" extends the process these services delivers from an external source.

Whereas, "insourcing" is a way by which organisation search their employee base for those who might be the most qualified to carry out the necessary tasks. A alternative kind of insourcing recruits professionals on a temporary basis to work on-site at a business and occasionally assist in training other staff members rather than using current personnel. The fact that the temporary worker is "brought in" makes him or her an insourced employee even though they are external to the business.

These applications consists of the following-

Outsourced applications-

The ones which were brought from outer IT agencies and were not developed by Bansal's own IT personnels.

Insta – Most important application of the entire HMIS of the hospital. This application was used for maintaining entire department activity, retrieving patient information, providing relevant information to patients. This application was modified and structured according to different departments and the type of activities carried out in those departments.

PACS – All the images and reports of the diagnosis were stored in this application.

Zimbra – This application was used for sending and receiving mails from respective sources by concerned authorities and healthcare employees.

In house applications-

The ones which were developed by Bansal's own IT personnels for their relevant use.

KIOSK- New patient registration was done under this application.

Pharmacy drug database – Data related to all the drugs of use in the hospital including available drugs in the pharmacy, those which were to be ordered to maintain the normal stock, was all available under this application (Entire pharmacy drugs data).

Doctor availability- Doctors everyday availability and timings was provided in this application.

Radiology TAT- TAT was calculated and stored on this application as soon as employees add their respective time taken from start to end of the radiology process.

Nursing Station TAT- TAT of nursing station was calculated and stored under this application.

Hospital TAT- TAT of different departments of the hospital was available in this application.

Patient transfer- Data of all the patients as well as inpatients who were being or had been transferred from one department to the other department or to the other hospital was stored and available under this application.

Discharge kit- Entire data related to inpatients who were discharged from the hospital was stored and available under this application.

Complain management- Patient complaint platform was provided and those complaints were managed in this application.

Duty Roaster- Assignment of the employees to their respective job or duty was done and that particular data along with proper dates and schedule was maintained under this application.

Dietary System- Maintenance of the entire diet system of the inpatients and their diet schedules were provided here.

Patient test status- The status of different types of tests and diagnosis of patients was provided here.

Pathology database- Data related to entire pathology reports of the patients were available under this application.

Abbreviations- This application stored and maintained the data of all the relevant used terms with their true abbreviations and their misinterpreted terms or meanings to avoid them.

Room booking- It was done manually/ physically, therefore it was not used in HMIS.

Virtual tour- A virtual guide to all departments and areas of hospital was provided here.

TV Display- Display of the status of undergoing test and appointments of patients was provided under this application.

E Library Proquest- Entire literature that was of use for doctors and healthcare employees was available in this E Library application.

Hospital policy- Written standard policies and guidelines related to entire management of hospital was available under this application.

Sentinel- Sentinel incidents were reported and stored under this application by the concerned individuals, necessary actions were taken in response to those events or incidents.



HMIS window of the hospital system (image 6)



REPORTS COMPONENT OF HMIS (image 7)

The screenshot shows the 'VISITS SEARCH' interface. At the top, there is a 'Search Patient Visits' section with a 'Search' button and a 'Less Options <<' link. Below this, there are several search filters:

- MR No./Patient Name:** A text input field.
- Active Only:** A checkbox that is checked.
- Patient Details:**
 - Patient Full Name:** A text input field.
 - Mobile No.:** A text input field.
 - Complaint:** A text input field.
 - Date Of Birth:** A date picker.
 - Admission Date:** A date range picker with 'From' and 'To' fields.
- Status:**
 - ☒ (All)
 - ☐ Active
 - ☐ Inactive
- Type:**
 - ☒ (All)
 - ☐ IP
 - ☐ OP
- OP Type:**
 - ☒ (All)
 - ☐ Main Visit
 - ☐ FollowUp
 - ☐ FollowUp(No Cons.)
 - ☐ Revisit
 - ☐ Outside
- Department:** A dropdown menu with '--Select--'.
- Doctor:** A dropdown menu with '--Select--'.
- Ward:** A text input field.
- Bed Name:** A text input field.
- Location:**
 - Country:** A text input field.
 - State:** A text input field.
 - City:** A text input field.
 - Area:** A text input field.
 - Discharge Date:** A date range picker with 'From' and 'To' fields.
- Discharge Summary Status:**
 - ☒ (All)
 - ☐ No Documents
 - ☐ Open
 - ☐ Finalized
- Finalized By:** A text input field.
- Finalized Date:** A date range picker with 'From' and 'To' fields.

At the bottom, there is a 'Generic Search Options' section with two dropdown menus: 'Custom & Registrat' and 'Registration Field...'. A 'Search' button is located at the bottom right.

PATIENT SEARCH IN HMIS (image 8)

HMIS Usage in different departments which includes-

It can be used in various departments of a hospital to automate tasks, improve communication, and track patient data. Here is a brief overview of how HMIS was used different departments of Bansal Hospital:

IPD - The applications of the HMIS used in the OPD department includes-

- Insta
 - Duty Roaster
 - Doctors availability
 - Telephone directory
 - Patient admission (Patient details and documents upload)
 - Issuing of file and pass
 - Describing hospital details to attendants and patients
 - Adding of diagnostic test orders
 - Payment processing (cash, card or UPI)
 - Checking discharge and processing payment after that
 - Issuing of payment discharge release slip
 - Issuing of bill
 - Amount settlement and refund process
- HMIS can be used to manage patient admissions, transfers, and discharges. It can also be used to track patient demographics, medical history, diagnosis, and treatment plans. HMIS can help doctors and nurses

Room booking was still handled through calls without HMIS.

Issues faced in the IPD department related to HMIS includes-

- Slow payment processing
- Software hang (lagging of process after entry of BH number)
- System shut down/ Server down

OPD - The applications of the HMIS used in the OPD department includes-

- Insta
- Kiosk
- Duty Roaster
- Doctors availability

- Pharmacy drug list
- Telephone directory
 - Streamlining patient appointments /doctor consultations
 - Patient registration
 - Adding Test orders
 - Bill payments for test orders as well as consultations
 - Helping doctors and nurses in accessing patient records, viewing lab reports and prescribing medications.
 - To reduce waiting time, improve patient satisfaction and increase revenue.

Issues faced in the OPD department related to HMIS includes-

- Connectivity issue
- Software hanging
- System shut down/ Server down

Emergency Room(ER)-

- Triage of patients
- Prioritizing care and tracking treatment through access of patient records.
- Sharing of information with other departments.
- Open bills, search, lab sample
- Helping staff in communicating with each other.
- To reduce errors, improve outcomes and increasing efficiency.

Issues faced in the OPD department related to HMIS includes-

- Slow processing
- System shut down/ Server down

Radiology –

The applications of the HMIS used in the OPD department includes-

- Insta – Saving and typing of report for live system diagnosis that is USG.
 - Storing of reports for other diagnosis test system.
- PACS – All images and reports of the diagnosis (CT, MRI) are stored in this application.

- Radiology TAT
(X ray – 2hrs)

USG Room

- Open BH number of the patient under diagnosis
- Open format Sonography
- Typing of report
- Saving and signing off of report, printing
- Changing the status to “conducted” on Insta platform.

Issues faced in the OPD department related to HMIS includes-

- Server down
- Slow processing
- No autosave feature (copy and save while typing)
- Content search difficult
- Finding of reports is tedious and time consuming
- No add to dictionary feature (not working)
- No short cut on Insta in order to increase the speed of performing OPD tasks.
- 3 step before final report printing of order and bill receipts.
- Format making for some type of USGs (Format not present and updated for some type of USGs)

Pharmacy (IPD, OPD and Central pharmacy) – The applications of the HMIS used in the Pharmacy department includes-

- Insta
- Zimbra
- Drug database
- Telephone directory
(First in first out method of inventory followed, Alphabetical order maintained)

HMIS helped manage inventory, track medication dispensing, and generate invoices. It helped pharmacist access patient records, view medication history, and check for drug interactions. HMIS helped reduce errors, improve safety, and increase revenue.

- Issuing medicines and generating invoices (Open patient BH no, add items , processing of payment)
- Indent Processing (Stock reorder)
[Reordering from central pharmacy for OPD pharmacy]
- Prescription audit (only in OPD Pharmacy)
- Medical audit by audit manager (checking inventory)

CENTRAL PHARMACY

- GRN Stock entry/ View GRN
- Reorder level maintaining
[Indent from Purchase department]
- Viewing purchase order, indent (all stores)
- Raising transfer indent, approving indent(save and process), processing indent, receiving indent, rejecting transfer indent
- Supplier return/ replacement (before 3 months from expiry date)
- Stock ledger

Issues faced in the Pharmacy department related to HMIS includes-

- Server down (502 gateway)
[No billing, no medicine search, no patient search]
- System crashing
- Slow processing
- GRN (Goods receive note) not saved
- Indent transfer multiple times (shown by errors)

TPA (Third Party Administration)-

The applications of the HMIS used in the TPA department includes-

- Insta (bill payment)
- Separate TPA application (for TPA work processing)
- Telephone directory
- Preauthorization form filling of both doctor and patient
- Sending the form to insurance company through insurance portal.
- Receiving of the approval from the company.
- Management of the query raised.
- Bill payment through Insta of HMIS

Issues faced in the TPA department related to HMIS includes-

- Server down (502 gateway)
- Connectivity issue
- Slow processing

CSSD (Central Sterile Supply Department) -

- Management of equipments and supply inventory
- Tracking of sterilization processes

- Generating reports
- Accessing patient records.
- Sharing of information with other departments
- Reducing of errors, improving outcomes and increasing efficiency.

Issues faced in the CSSD department related to HMIS includes-

- Server down
- Connectivity issue
- Slow processing

Pathology-

- Management of patient specimens
- Tracking of laboratory results and generating reports
- Helps staff communicating with each other
- Accessing patient records.
- Sharing of information with other departments
- Reducing of errors, improving accuracy and increasing efficiency.

Issues faced in the Pharmacy department related to HMIS includes-

- Server down
- Connectivity issue
- Slow processing

Health Check Up-

The applications of the HMIS used in the Health Check Up department includes-

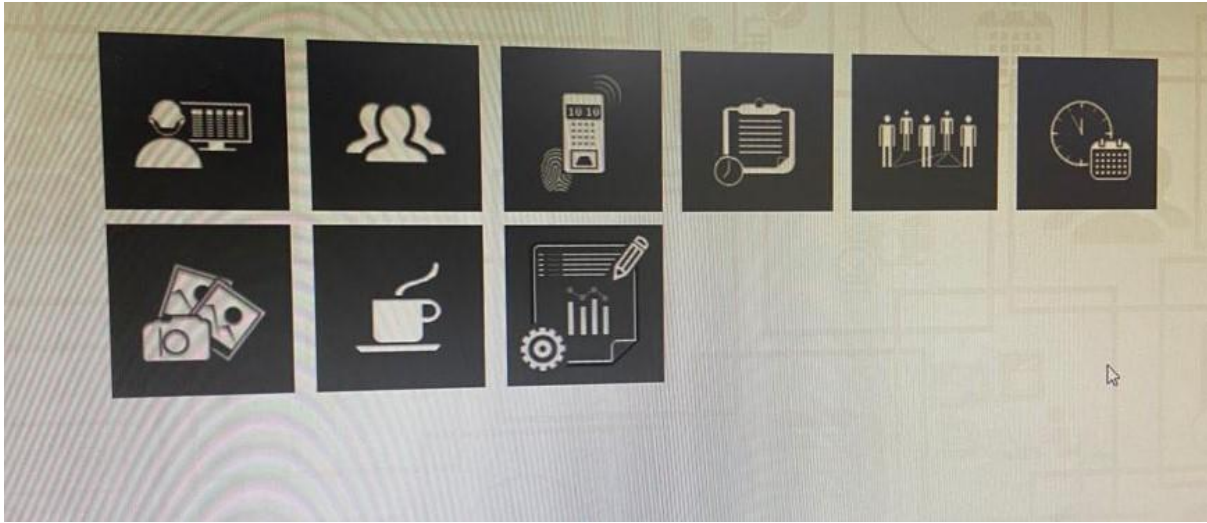
- Insta (for health check up activity)
- Zimbra (for sending and receiving mails from respective sources)
- Telephone directory
- Patient test status
- Abbreviations
- Doctors availability
- Complain management
- Pathology database

Issues faced in the HR department related to HMIS includes-

- Server down and system hanging
- Connectivity issue
- Hardware and equipment issues

Human Resource Department (HR)-

HMIS used in the HR department-



(Image 9) HMIS OF HR DEPARTMENT

The HMIS used in the HR department includes-

- Admin (Accessed by IT for specifying policies and rights given)
- User (For adding new joiners, their ID creation, to view old joiners, user configuration)
- Devices (biometric devices of the hospital connected)
- Shift and schedule (For shift making and maintaining, monthly shift processing, shift configuration)
- Designation department (For creating new designation department)
- Time and attendance (To view timings and attendance of the employees)
- Leave (For leave approval, to view leave balance and leave policies)
- Cafeteria (under process)
- Report builder (under process)

Issues faced in the HR department related to HMIS includes-

- Server down and system hanging
- Connectivity issue (disconnection)
- Slow processing

To summarise, HMIS was used in various departments of the hospital to improve patient care, increase efficiency, and reduce errors. By automating tasks, streamlining processes, and facilitating communication, HMIS could help healthcare providers or workers in delivering high-quality care and in improving the patient outcomes.

EVALUATION OF HMIS SATISFACTION AMONG HEALTHCARE WORKERS

4) MATERIALS AND METHODS

Study type- Prospective and observational study had been carried out to analyse and also to correlate the HMIS utilization and its satisfaction level among the healthcare workers of the Bansal hospital.

Study period- The particular study had been carried out for a period of three-month duration in Bansal Hospital Bhopal.

Total - 22.02.2023 –21.05.2023 - (3 months)

Literature Review - 22.02.2023 –03.03.2023

Data Collection - 04.03.2023 –31.03.2023

Data analysis - 01.04.2023 –30.04.2023

Preparation of Report and thesis - 01.05.2023 – 20.04.2023

Study area- It included the following departments of the hospital – OPD, IPD, ER, Pathology, Radiology, HR, Pharmacy, Health Check Up.

Sample size- A sample of 110 survey reports was taken up for the study.

OPD- 15

IPD- 15

ER- 10

PHARMACY- 20

PATHOLOGY- 15

RADIOLOGY- 15

HR- 15

HEALTH CHECKUP- 5

Sampling method-

Purposive as well as convenience sampling had been used in the study for data or info collection for analysing the HMIS adoption rate, HMIS satisfaction and HMIS utilization among the healthcare workers.

Data collection technique-

- Questionnaire – For evaluation of HMIS satisfaction among healthcare workers, primary data was gathered from 110 respondents via questionnaire using Excel sheets. (4)
In order to assess the survey's reliability, a valid questionnaire on HIMS acceptability had been prepared. The value of Cronbach's alpha of 0.781 showed that the study used reliable question or survey form. The questionnaire consisted of two divisions: first division outlined the demographics and broad data, and second division contained questions concerning five independent variables and one dependent variable of EUCS model. Each of the question was scored on a Likert scale which was having a range of 1 to 5.
Closed ended study had been done.
- Personal interview-
 - 1) Healthcare workers- For determination and analysis of HMIS usage
 - 2) IT Department professionals- For the study of HMIS implementation in the hospital.
- Direct Observation- For determination and analysis of HMIS usage.

To accomplish these goals, the research methodology involved both the quantitative as well as the qualitative approaches. Data was collected through surveys, interviews, and observations of the hospital staff, including nurses, and administrative personnel.

Data analysis methodology-

- A) Data analysis - on MS Excel / Graphical analysis – with the help of bar graphs and pie charts.
- B) (EUCS) or End User Computing Satisfaction Model –data analysis and satisfaction evaluation purpose. (13,14)

EUCS MODEL

1. Content (A1)

It is a dimension used to measure user satisfaction which is in terms of the content of a system. The contents of the system are in the form of functions and modules used by system users and also information generated by the system.(16) The dimension also measures whether the system produces information that is appropriate with user needs. Greater the completeness of the module and the information in the system, the greater the level of satisfaction of users.

2. Accuracy (A2)

It is a dimension used to measure user satisfaction in terms of data accuracy which is when the system receives input and then processes it into information. It is measured by seeing how frequently the system produces the wrong output when managing user input. Besides that, it can also be seen from how frequently the errors occur in the data management process

3. Format (A3)

It is used to measure user satisfaction from the side of the application itself. The format dimension is focussed to measure user satisfaction in terms of appearance of the system interface design. The information format produced by the system is whether or not the system interface is interesting also whether the system appearance makes the system easy to use for users so that it can indirectly affect the level of user effectiveness.

4. Ease of use (A4)

Ease of use dimension is used to measure satisfaction in terms of user convenience or user friendliness in systems usage for eg, data input processes, data processing, and searching for the information needed. It evaluates whether the system is easy to navigate, whether users can easily enter and access data, and whether the system is intuitive to use.

5. Timeliness (A5)

It is used to measure user satisfaction in terms of system timeliness in providing information or the data needed by users. Timely systems can be classified as real-time systems. This means that every user made request or input will be immediately processed and the output will be displayed correctly without any longer time consumption.

6. User Satisfaction (B)

It can be described as the complete user satisfaction determined by perceived value factors, perceived quality and user expectations to the overall customer which has behavioural consequences and that too in the form of customer complaints and customer loyalty.

Extremely Not Good 20-35%

Not Good 36 – 51%

Fairly Good 52 – 67%

Good 68 – 83 %

Very Good 84 – 100%

Ethical considerations-

Consent of the healthcare workers had been taken verbally for this study. This study involved direct interaction with the workers, their feedback forms and the data used was primary data.

Inclusion and exclusion criteria-

Inclusion criteria- Only HMIS using hospital staff responses were included in the study

Exclusion criteria- Other clinical staff (including doctors) were excluded from the study.

5) DATA ANALYSIS

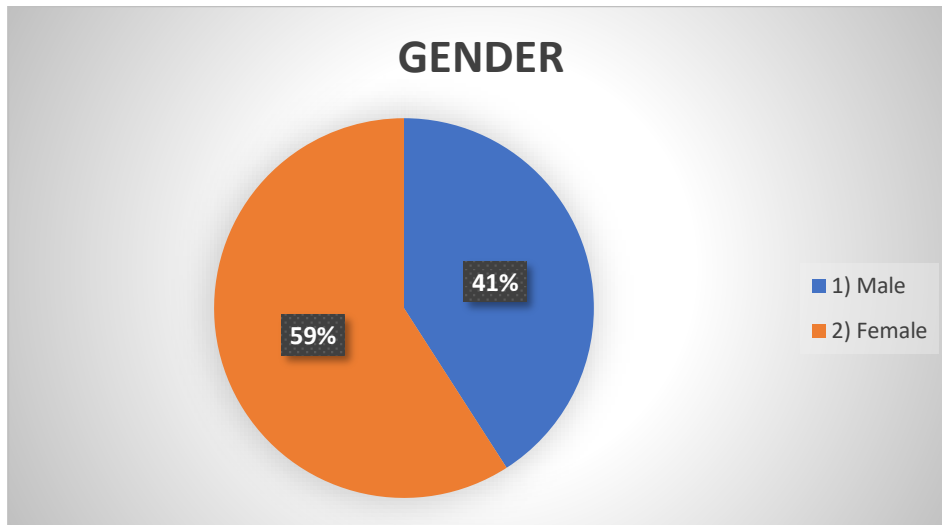
5.1 Demographic details

The demographic details of 110 respondents of the Bansal hospital is presented below:-

1. GENDER OF THE RESPONDENTS

Gender of the respondents	110- Total
Male	45
Female	65

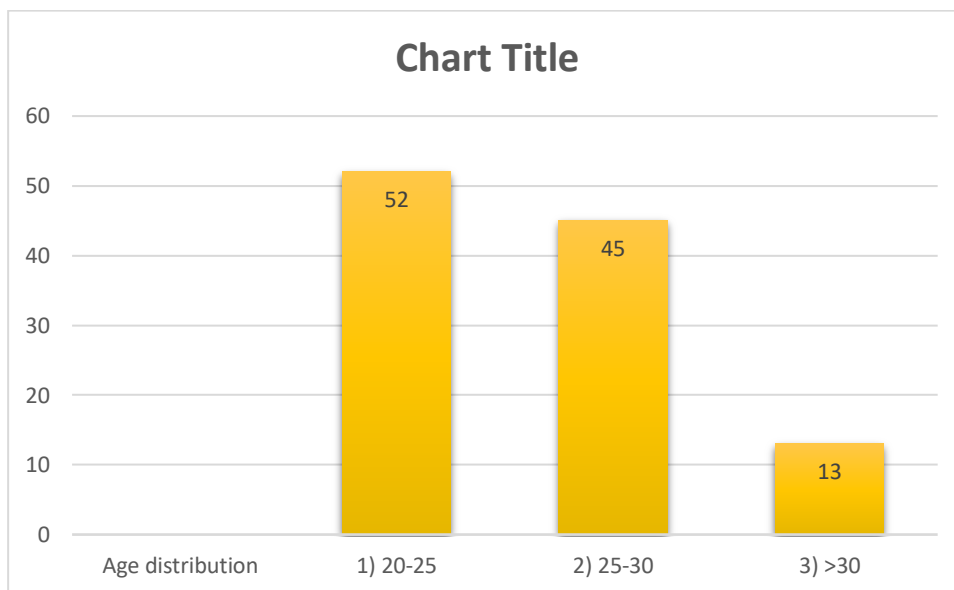
Table 1



Graph 1

Out of 110 respondents, we had 45 male and 65 female respondents who were using HMIS.

2. AGE DISTRIBUTION



Graph 2

Out of 110 respondents, (47%) 52 respondents were of the age group between 20-25 years, (41%) 45 respondents were of the age group between 25-30 years, (12%) 13 respondents were of the age group greater than 30 years.

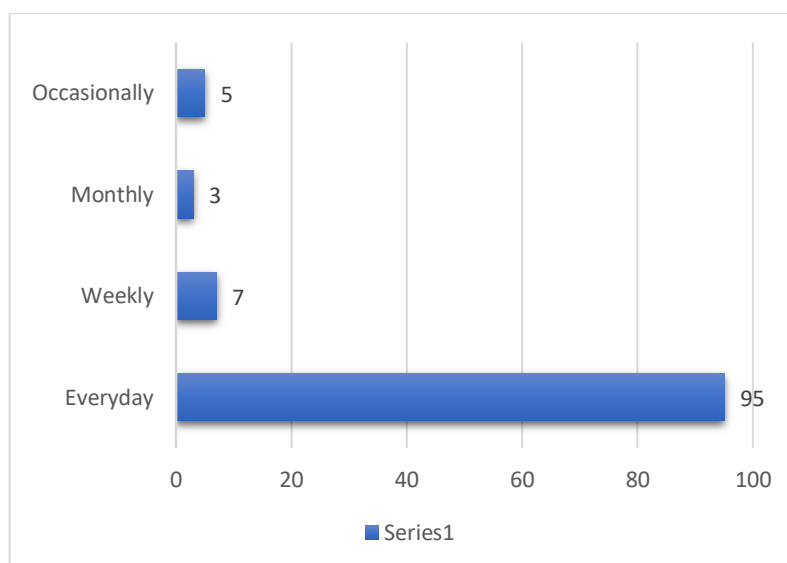
3. COMPLAINE OF USING HMIS

Respondents usage of HMIS compliance	
Yes	110
No	0

Table 2

All 110 respondents were using HMIS.

4. FREQUENCY OF HMIS USAGE



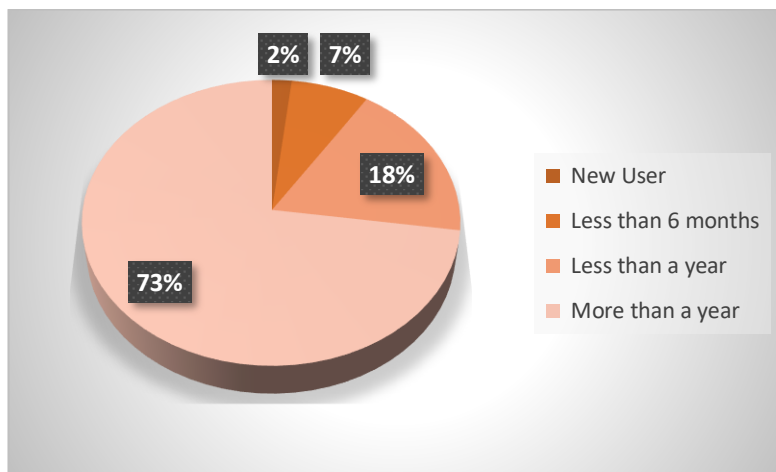
Graph 3

Out of 110 respondents, 86% respondents were daily HMIS users, 6% respondents were weekly HMIS users, 3% respondents were monthly HMIS users and 5% respondents were occasional HMIS users. Conclusively, 14% did not use HMIS daily, that means they used HMIS only when other staff was not available.

5. TIME PERIOD OF HMIS USAGE

Since how long have you been using HMIS?	110- Total
New User	2
Less than 6 months	8
Less than a year	20
More than a year	80

Table 3

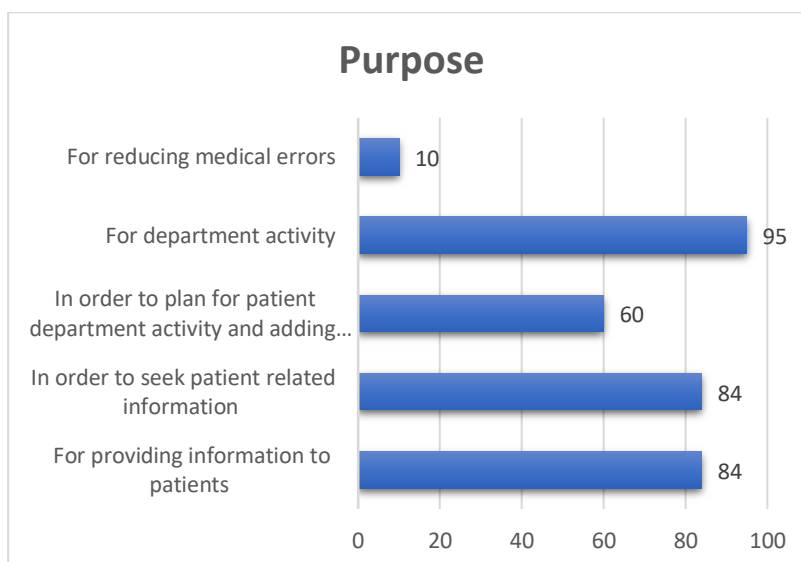


Graph 4

2% respondents were new users and were getting adapted with the HMIS usage in the hospital, 7% respondents were using HMIS for less than 6 months, reason for their short usage is their new recruitment in the hospital.

18% respondents were using HMIS for less than a year and majority of the respondents, that is, 73% respondents were using HMIS for more than a year.

6. PURPOSE OF HMIS USAGE



(Multiple responses taken) Graph 5

HMIS was mostly used for the departmental activity, that corresponded to 86% respondents' usage.

Second purpose for which HMIS was used the most was for providing information to patients and in order to seek patient related information, that corresponded to 76% of respondents' usage.

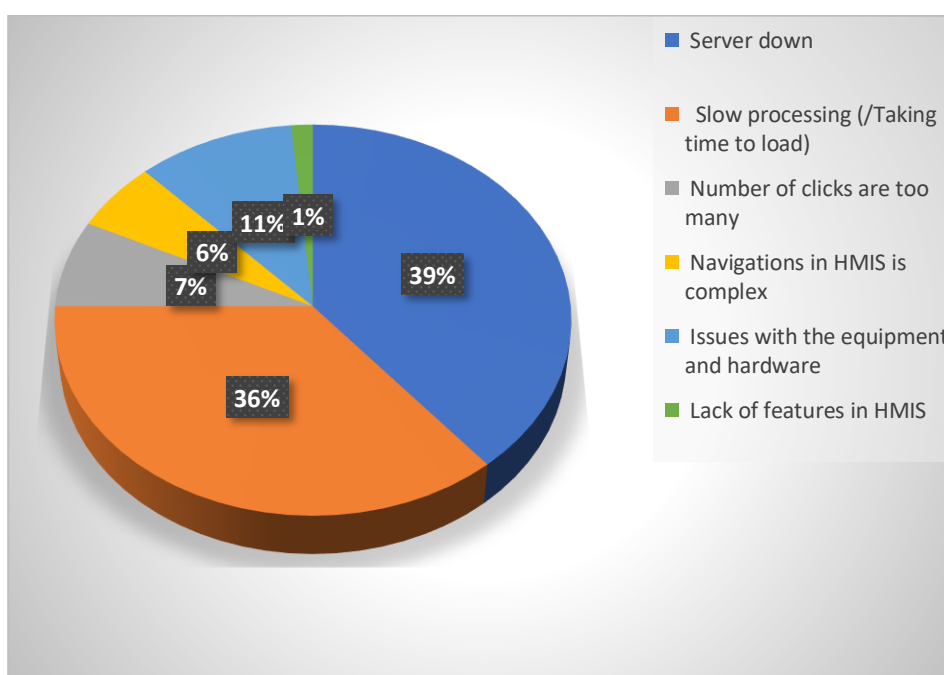
Apart from these, HMIS was also being used planning for patient department activity and adding orders and that corresponded to 55% of respondents' usage.

9% of HMIS respondents' usage was for serving the purpose of reducing medical errors.

7. ISSUE FACED WHILE USING HMIS

Issues faced while using HMIS (Multiple responses taken)	
Server down	81
Slow processing (/Taking time to load)	75
Cumbersome process	15
Navigations in HMIS is complex	12
Issues with the equipment and hardware	22
Lack of features in HMIS	3

Table 4



Graph 6

Major issue detected with the HMIS system of the hospital was of server down which was faced by 39% of the respondents.

Slow processing and taking time to load data was another major issue faced with HMIS by 38% of the respondents.

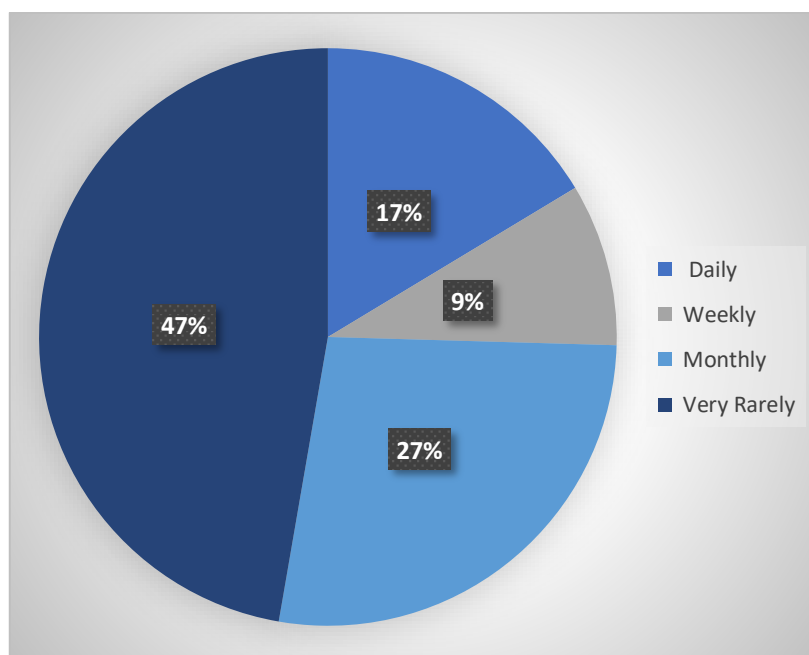
Issues with the equipments and hardware connected with the HMIS and aids in the normal functioning of departments was another hindrance faced by 11% of the respondents.

Other issues faced while using HMIS includes, complex HMIS navigation, lack of features in HMIS, too many steps and clicks for undergoing HMIS radiology department function making it time consuming.

8. FREQUENCY OF DIFFICULTIES FACED WHILE USING HMIS

How often are the difficulties faced by the respondents? (Multiple responses taken)	
Daily	18
Weekly	10
Monthly	30
Very Rarely	52

Table 5



Graph 7

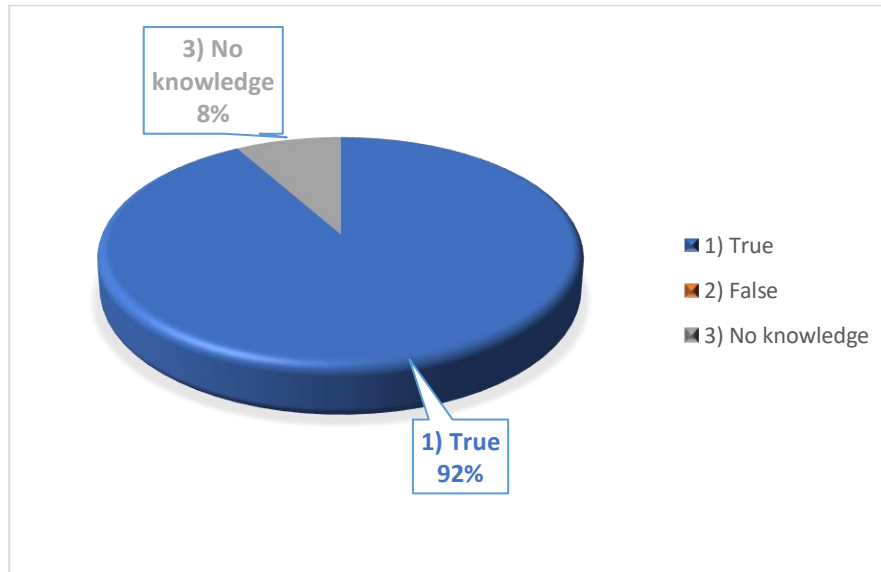
Out of 110 respondents, 17% of the respondents faced issues with HMIS on a daily and regular basis while rest 83% of the respondents faced HMIS issues in an infrequent manner.

Majority of the respondents were rarely facing issues with HMIS which was concluded to be a good sign for technology adoption and HMIS satisfaction part of the hospital.

9. AWARENESS ABOUT CONNECTION WITH OTHER DEPARTMENTS

Is HMIS in the hospital interconnected with other relevant departments of the hospital? (Connection with other departments)	110- Total
1) True	101
2) False	0
3) No knowlegde	9

Table 6



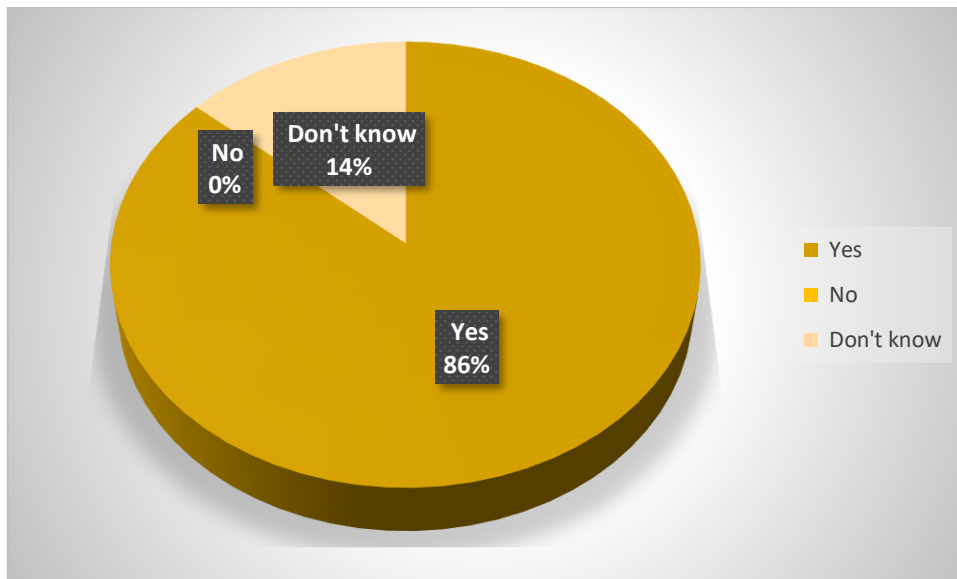
Graph 8

8% of the respondents were unaware that HMIS system of the hospital is interconnected with other relevant departments as well. They were just aware about it being used to complete their assigned task for their job in that department. 92% of the respondents were aware about HMIS being a comprehensive system and how different components of the hospital are interconnected to give a holistic care to the patients and efficiently manage different departmental activities.

10. CONFIDENTIALITY MAINTAINANCE WITH HMIS

Awareness about HMIS maintaining confidentiality of patient information.	110- Total
Yes	95
No	0
Don't know	15

Table 7



Graph 9

Around 86% of respondents out of total of 110 respondents, believed that HMIS did maintain confidentiality of patient information, while 14% were unaware about this information.

Descriptive Analysis

We used qualitative analysis for describing the results data obtained by filling out respondents' answers at the study process time.

The data description was gained through the answers of 110 users studied with 25 items on the form filled in 6 research variables. There are 5 items in the content variable (A1), 5 items in the accuracy variable (A2), 5 items in the format variable (A3), 5 items in the ease of use variable (A4), 5 items in the timeliness variable (A5), and worker satisfaction depicting dependent variable (B) was calculated from these independent variables.

Research questionnaire results for each variable are as followed :-

1. Variable Content (A1) –

Answer of the workers from the form submitted belong to the category of :-

[1] Much less [2] Less [3] Neutral [4] High [5] Very high

An analysis is conducted using the appropriate Likert Method.

Steps being followed:

- i) Determination of the amount of interval (I) (using following formula)-

$$I = (NT - NR)/K$$
$$= (25-5)/5 = 4$$

- ii) Determination of the score of criterion (called as score of performance) ($\Sigma PS1$)

$\Sigma PS =$ Highest score each of statement item X Item statements number X
Total respondents number

$$\Sigma PS1 = 5 \times 5 \times 110 = 2750$$

- iii) Total score obtained from the variable (A1) data collection results

Results from the score numbers ($\Sigma TS1$) = 1899

- iv) Determination of percentage (P1)

$$P1 = ((\Sigma TS1)/(\Sigma PS1)) \times 100$$
$$= (1899/2750) \times 100$$
$$= 69.05\%$$

This depicted calculation process, the categories range in particular is obtained, and the categories range is given by:

Much Poor = 20-35%

Poor = 36 – 51%

Fairly or Appreciably Good = 52 – 67%

Good = 68 – 83 %

Excellent = 84 – 100%

From the categories range, it is clear that the results distribution of the percentage of the responses on the basis of Content variable (A1) is 69.05% that is included or classified in the Good category.

2. Variable Format (A2) –

Answer of the workers from the form submitted belong to the category of :-

[1] Everytime [2] Most time [3] Half time [4] Rarely [5] Never

An analysis is conducted using the appropriate Likert Method.

Steps being followed:

i) Determination of the amount of interval (I) (using following formula)-

$$I = (NT - NR)/K$$
$$= (25 - 5)/5 = 4$$

ii) Determination of the score of criterion (called as score of performance) (ΣPS_2)

$\Sigma PS = \text{Highest score each of statement item} \times \text{Item statements number} \times \text{Total respondents number}$

$$\Sigma PS_2 = 5 \times 5 \times 110 = 2750$$

iii) Total score obtained from the variable (A2) data collection results

Results from the score numbers (ΣTS_2) = 1840

iv) Determination of percentage (P2)

$$P_2 = ((\Sigma TS_2)/(\Sigma PS_2)) \times 100$$
$$= (1840/2750) \times 100$$
$$= 66.90\%$$

This depicted calculation process, the categories range in particular is obtained, and the categories range is given by:

Much Poor = 20-35%

Poor = 36 – 51%

Fairly or Appreciably Good = 52 – 67%

Good = 68 – 83 %

Excellent = 84 – 100%

From the categories range it is clear that the results distribution of the percentage of the responses on the basis of Format variable (A2) is 66.90% that is included or classified in the Fairly Good category.

3. Variable Accuracy (A3) –

Answer of the workers from the form submitted belong to the category of :-

[1] Much less [2] Less [3] Neutral [4] High [5] Very high

An analysis is conducted using the appropriate Likert Method.

Steps being followed:

i) Determination of the amount of interval (I) (using following formula)-

$$I = (NT - NR)/K$$

$$= (25 - 5)/5 = 4$$

ii) Determination of the score of criterion (called as score of performance) ($\Sigma PS3$)

ΣPS = Highest score each of statement item X Item statements number X
Total respondents number

$$\Sigma PS3 = 5 \times 5 \times 110 = 2750$$

iii) Total score obtained from the variable (A3) data collection results

$$\text{Results from the score numbers } (\Sigma TS3) = 1980$$

iv) Determination of percentage (P3)

$$P3 = ((\Sigma TS3) / (\Sigma PS3)) \times 100$$

$$= (1980 / 2750) \times 100$$

$$= 72.0\%$$

This depicted calculation process, the categories range in particular is obtained, and the categories range is given by:

Much Poor = 20-35%

Poor = 36 – 51%

Fairly or Appreciably Good = 52 – 67%

Good = 68 – 83 %

Excellent = 84 – 100%

From the categories range, it is clear that the results distribution of the percentage of the responses on the basis of Accuracy variable (A3) is 72.0% that is included or classified in the Good category.

4. Variable Ease of Use (A4) –

Answer of the workers from the form submitted belong to the category of :-

[1] Much less [2] Less [3] Neutral [4] High [5] Very high

An analysis is conducted using the appropriate Likert Method.

Steps being followed:

i) Determination of the amount of interval (I) (using following formula)-

$$I = (NT - NR)/K$$
$$= (25 - 5)/5 = 4$$

ii) Determination of the score of criterion (called as score of performance) ($\Sigma PS4$)

ΣPS = Highest score each of statement item X Item statements number X
Total respondents number

$$\Sigma PS4 = 5 \times 5 \times 110 = 2750$$

iii) Total score obtained from the variable (A4) data collection results

$$\text{Results from the score numbers } (\Sigma TS4) = 1835$$

iv) Determination of percentage (P4)

$$P4 = ((\Sigma TS4)/(\Sigma PS4)) \times 100$$
$$= (1835/2750) \times 100$$
$$= 66.70\%$$

This depicted calculation process, the categories range in particular is obtained, and the categories range is given by:

Much Poor = 20-35%

Poor = 36 – 51%

Fairly or Appreciably Good = 52 – 67%

Good = 68 – 83 %

Excellent = 84 – 100%

From the categories range, it is clear that the results distribution of the percentage of the responses on the basis of Ease of Use variable (A4) is 66.70% that is included or classified in the Fairly Good category.

5. Variable Timeliness (A5) –

Answer of the workers from the form submitted belong to the category of :-

[1] Never [2] Rarely [3] Half time [4] Most time [5] Everytime

An analysis is conducted using the appropriate Likert Method.

Steps being followed:

i) Determination of the amount of interval (I) (using following formula)-

$$I = (NT - NR)/K$$

$$= (25 - 5)/5 = 4$$

ii) Determination of the score of criterion (called as score of performance) ($\Sigma PS5$)

$\Sigma PS =$ Highest score each of statement item X Item statements number X
Total respondents number

$$\Sigma PS5 = 5 \times 5 \times 110 = 2750$$

iii) Total score obtained from the variable (A5) data collection results

$$\text{Results from the score numbers } (\Sigma TS5) = 2126$$

iv) Determination of percentage (P5)

$$P5 = ((\Sigma TS5) / (\Sigma PS5)) \times 100$$

$$= (2126 / 2750) \times 100$$

This depicted calculation process, the categories range in particular is obtained, and the categories range is given by:

Much Poor = 20-35%

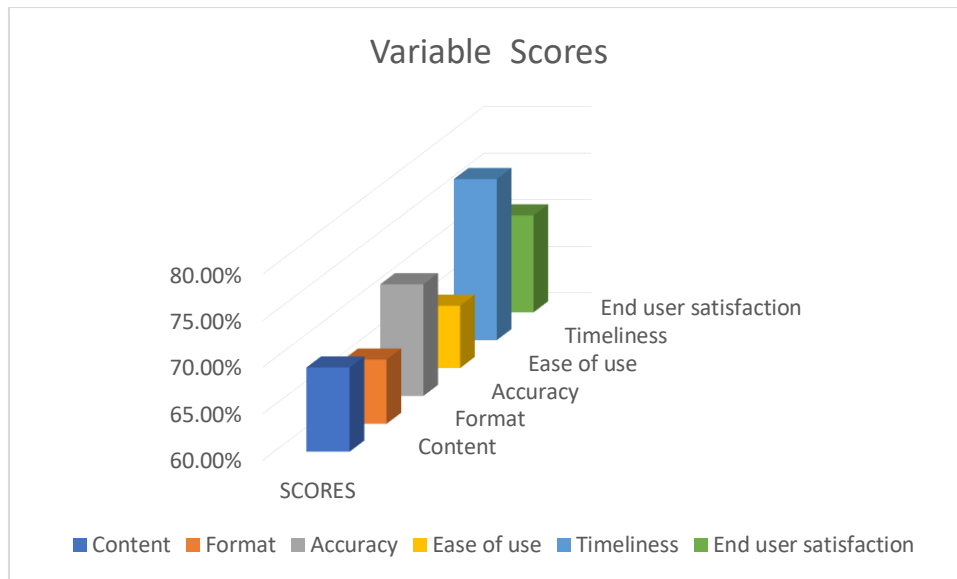
Poor = 36 – 51%

Fairly or Appreciably Good = 52 – 67%

Good = 68 – 83 %

Excellent = 84 – 100%

From the categories range, it is clear that the results distribution of the percentage of the responses on the basis of Timeliness variable (A5) is 77.30% that is included or classified in the Good category.



(Graph 10) SCORES OF ALL VARIABLES

6. End-User Satisfaction (B) [Dependent Variable]–

Variable End-User Satisfaction (B) = $(A1 + A2 + A3 + A4 + A5) / (\sum PS1 + \sum PS2 + \sum PS3 + \sum PS4 + \sum PS5)$

$$\begin{aligned}
 B &= (1899 + 1840 + 1980 + 1835 + 2126) / (2750 \times 5) \\
 &= 9680 / 13750 \\
 &= 0.704
 \end{aligned}$$

$$\begin{aligned}
 \text{Percentage of Variable End-User Satisfaction (PB)} &= B \times 100 \\
 &= 0.704 \times 100 \\
 &= 70.4\%
 \end{aligned}$$

From the categories range, it is observed that the End User Satisfaction variable (B) derived or calculated is 70.4% which is included or classified in the Good category.

6) RESULTS AND DISCUSSION

- All of 110 respondents showed compliance for using HMIS.

CONFIDENTIALITY

- Majority of the respondents believed that HMIS maintained **confidentiality** of patient information.
- All the employee respondents believed that HMIS was the important part of the hospital.

ADOPTION

- 86% respondents were daily HMIS users and only 5% were occasional users.
- Majority of the respondents, that is, 73% respondents were using HMIS for more than a year and were well adapted with the HMIS of the hospital.
- On the other side, it appeared that users' system knowledge was the foundation for how beneficial something was seen to be and could be adopted. It could be beneficial for the technical staff to make an effort to build a larger user community and to offer users more thorough training and support.

USAGE

- **Usage** of HMIS was done mainly for departmental activity, that corresponded to 86% of respondents' usage. Second important usage of HMIS was for providing information to patients and in order to seek patient related information, that corresponded to 76% of respondents' usage.
- Other usage of HMIS was planning for patient activity, adding orders and for serving the purpose of reducing medical errors.

AWARENESS

- Majority (that is, 92%) of the respondents were aware about HMIS being a comprehensive system and how different components of the hospital were interconnected to give a holistic care to the patients and efficiently manage different departmental activities.
- This indicates that there was a good **awareness** about HMIS system among the healthcare employees of the Bansal Hospital.
- Though 8% of the respondents had unawareness about HMIS of the hospital being interconnected with other relevant departments and so the area was marked as the area for improvement and interventions were suggested.

ISSUES

- Major issues detected with the HMIS system of the hospital was of server down and slow processing of the system corresponding to 39% of respondents.
- 17% of the respondents were facing issues with HMIS on a regular basis.

- Majority of the respondents were rarely facing **issues** with HMIS and this was concluded to be a good sign for technology adoption and HMIS satisfaction part of the hospital, still the area was marked for applying intervention in order to eliminate and reduce the frequency of issues faced by some of the respondents to improve the end user satisfaction with HMIS.

The variables usage in the study includes:

Content (A1)
Accuracy (A2)
Format (A3)
Ease of Use (A4)
Timeliness (A5)
User Satisfaction (B)

Variable measurement scale in the study used Likert Scale.

The results of the study concluded that the Content (A1), Accuracy (A2), Format (A3), Ease of use (A4), and Timeliness (A5) were in a fairly good and good category, with an average percentage of 69.05%, 72.0%, 66.90%, 66.70%, and 77.30%. The research results also concluded that based on the results of descriptive analysis, the variable User Satisfaction (B) on Hospital Management Information System according to each question was in the Good category with an average value of 70.4%.

Summary of the results

PROCESS BASED

- 86% indicated that the HMIS was maintaining the confidentiality of patient information
- 92% of the respondents were aware about HMIS being a comprehensive system and is interconnected with the different departments of the hospital.
- Overall user satisfaction with HMIS of Bansal hospital was 70.4% which is appreciably good.

CHALLENGE BASED

- 17% of participants were experiencing problems while using HMIS on a regular basis and 47% rarely faces any issues while working with HMIS.
- The most common problems experienced: 1. Server down and slow processing 2. System hanging 3. Absence of sufficient training to users.

HMIS MAIN BENEFITS

- A. Helped in enforcing of the process.
- B. To users (especially for the data operators and clinicians) was that the entire process was paperless.

7) LIMITATIONS AND RECOMMENDATIONS

The main and critical limitation of our study was its appreciably small sample size, thus if we wished to generalise the results, we would be in requirement of conducting a subsequent study with an appreciably larger sample size.

INTERVENTIONS (Recommendations)-

Healthcare services should be delivered in an efficiency and successful manner and concerning that hospital workers' satisfaction with HMIS is essential. On the basis of the results of our study or thesis, we recommend these following interventions that can be taken to raise hospital workers' satisfaction with HMIS:

- 1) **Training and Support:** Giving healthcare staff sufficient training and continuing assistance so they can utilise the HMIS efficiently. This may entail making user guides accessible, offering technical help, and holding frequent training sessions. (14)
- 2) All healthcare workers should be given an equal opportunity to handle HIMS on a rotational basis, to empower them with technology.
- 3) **Standardisation:** Ensuring that all hospital departments and units use the HMIS consistently. As a result, procedures might be simplified, and confusion and errors might be reduced.
- 4) **Clear Communication:** Ensuring that the objectives, benefits, and limitations of the HMIS are explained to healthcare professionals in a straightforward and obvious manner. This intervention may involve updates in the regular system performance as well as great chances for staff members for making recommendations as well as express their concerns.
- 5) **Provision of User-Friendly Interface:** By ensuring that an intuitive interface which is simple to use and navigate by the healthcare workers is provided by HMIS. This can include components like obvious labelling, drop-down menus, and also intuitive iconography.
- 6) Modern features (such as hyperlinking, offline help for Windows, software, hardware, etc.) may be added to the HIMS system.
- 7) **Integration with Other Systems:** Making sure that the HMIS is integrated with other hospital processes and systems as well, such as electronic health records (EHRs) efficiently and patient care protocols. This can reduce effort duplication and will increase overall effectiveness.
- 8) **Rewarding and recognising healthcare professionals who successfully use the HMIS and contribute to its success.** Examples include bonuses, honoraria and general acclaim.
- 9) **Continuous Improvement:** Regularly reviewing and enhancing the HMIS based on input from stakeholders and healthcare professionals will lead to increasing the satisfaction with HMIS. For finding the areas that need improvement, this can involve conducting surveys, focus groups, and other types of models like variants of EUCS.

Overall, providing training, support, user-friendly interfaces, clear communication, standardisation, incentives and recognition, interaction with other systems, and continual development are necessary to increase healthcare workers' satisfaction with HMIS. Bansal Hospital can guarantee that its HMIS is effective and efficient and that healthcare personnel are happy with the way they utilise the system by putting these interventions into place.

8) CONCLUSION

This particular study on “HMIS – usage and satisfaction study through EUCS model” concluded or resulted that the HMIS overall end user acceptance was good, though there was an appreciable scope for improvement.

The thesis findings contributed to the understanding of HMIS implementation and usage in a hospital setting, and the EUCS model's applicability in assessing users' satisfaction with the system, provided insights into the effectiveness of HMIS in enhancing the quality of hospital services and patient outcomes through –

- 1) Improved employee retention.
- 2) Increased efficiency and productivity- Through effective management of health facilities and resources.
- 3) Improved patient care.
- 4) Monitoring collective/individual performance of hospitals across the administrative channel.
- 5) Cost savings- Through improvement in all dimensions of EUCS model and finally improvement in end user satisfaction
- 6) Gaining competitive advantage over other hospitals

HMIS end user satisfaction evaluation and enhancement was aimed at improvement in the resolution and addressing of the fundamental needs of concerned stakeholders and in this regard- Patient Satisfaction was the bottom-line of project. It facilitated ease of access to healthcare in hassle-free environment.

- Doctors were able to achieve faster delivery of service with Clinical Knowledge support.
- Administrators were able to take better decision with the systematic and intelligent data that is getting generated in HMIS.
- All the Medical Equipment, Medical processes and various IT systems were getting integrated with HMIS core.

The study also contributed to the existing or current body of knowledge on the implementation as well as healthcare information systems adoption in hospitals. The results of the study might be used to inform policymakers and healthcare administrators on the appropriate measures to take in order to enhance the adoption, usage and satisfaction of HMIS in hospitals.

9) SUPPLEMENTARY

9.1) ANNEXURE

Annexures 1.

Confidentiality: Study tools

Confidentiality : Your information will be kept private and anonymous throughout this survey. Without allowing for individual identification, the analysis of the survey findings will be distributed. It is entirely voluntary to take part in this study. You are willingly participating in this study by agreeing to fill out this questionnaire. You don't need to give a reason and you can leave the study at any time. I have some questions for you if you are willing to answer them.

9.2) Questionnaire used for satisfaction evaluation

QUESTIONNAIRE

NAME-

GENDER-

DEPARTMENT-

AGE-

SPECIALIZATION-

- 1) Do you use HMIS of the hospital?
 - ☐ Yes
 - ☐ No
- 2) What is the frequency of your HMIS usage?
 - ☐ Everyday
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Occasionally
- 3) Since how long have you been using HMIS?
 - ☐ New User
 - ☐ Less than 6 months
 - ☐ Less than a year
 - ☐ More than a year

- 4) Do you feel HMIS is an important system for Bansal hospital?
- ☐ Yes
 - ☐ No
- 5) Do you feel any limitations with the HMIS usage from among the following?
- ☐ Privacy and security issue
 - ☐ No real time update
 - ☐ Data migration
 - ☐ Inter-operability
 - ☐ Others
- 6) Which of the following issues you face while using HMIS?
- ☐ Server down
 - ☐ Connectivity issue
 - ☐ System freezing
 - ☐ Slow processing (/Taking time to load)
 - ☐ Number of clicks are too many
 - ☐ Navigations in HMIS is complex
 - ☐ Lack of equipment and hardware
 - ☐ Lack of Features in HMIS
- 7) How many times you face difficulties while using HMIS?
- ☐ Everyday
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Yearly
- 8) For what purpose you need and use HMIS? (from the following)
- ☐ For providing information to patients
 - ☐ In order to seek patient related information
 - ☐ In order to plan for patient discharge
 - ☐ For reducing medical errors
- 9) Is HMIS in your hospital interconnected with relevant departments of the hospital?
(Connection with other departments)
- ☐ True
 - ☐ Not True
 - ☐ No knowledge
- 10) Does the system maintains the confidentiality of patient information?
- ☐ True
 - ☐ Not True
 - ☐ No knowledge

I. CONTENT-

a) How satisfied are you with the content quality (accuracy and relevancy) of the HMIS system in your daily work?

[1] Much less [2] Less [3] Neutral [4] High [5] Much high

b) To what extent does the HMIS system meet your job requirements and tasks?

[1] Much less [2] Less [3] Neutral [4] High [5] Much high

c) How satisfied are you with the reliability and availability of content on HMIS system?

[1] Much less [2] Less [3] Neutral [4] High [5] Much high

d) To what extent do you believe that HMIS system has all the necessary features and functions in requirement for job performance?

[1] [2] [3] [4] [5]

e) To what extent does the HMIS system provide you with the necessary information related to your work?

[1] Very less [2] Less [3] Neutral [4] High [5] Very high

II. FORMAT-

a) How frequently do you encounter difficulties when using the HMIS system?

[1] Everytime [2] Frequently [3] Almost half time [4] Rarely [5] Never

b) How much do you feel that the HMIS system is limiting your ability to complete tasks efficiently?

[1]] Everytime [2] Frequently [3] Almost half time [4] Rarely [5] Never

c) How much do you feel that the HMIS system is constraining your ability to be creative or innovative in your work?

[1] Everytime [2] Frequently [3] Almost half time [4] Rarely [5] Never

d) How much do you feel that the HMIS system is positively affecting your ability to interact effectively with colleagues?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

e) How much do you feel that the HMIS system is positively affecting your ability to provide quality patient care?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

III. ACCURACY-

a) How satisfied are you with the accuracy of the information displayed in the HMIS system?

[1] Much less [2] Less [3] Neutral [4] High [5] Very high

b) To what extent does the accuracy of the system impact your ability to provide quality patient care?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

c) How frequently do you encounter inaccuracies or errors in the HMIS system?

[1] Everytime [2] Frequently [3] Almost half time [4] Rarely [5] Never

d) How confident you are in the system's ability to provide accurate and reliable data for decision making?

[1]Not at all [2]Low [3]Moderate [4]High [5]Very high

e) How much do you rely on the accuracy of the HMIS system in your day-to-day work responsibilities?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

IV. EASE OF USE-

a) To what extent does the HMIS meet your needs smoothly for performing your job tasks efficiently?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

b) How easy is it to learn to use and operate HMIS system effectively? To which extent would it be easy for you to become skilful at using HMIS?

[1]Very difficult [2]Difficult [3]Medium [4]Easy [5]Very easy

c) To what extent do you find HMIS flexible to interact with?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

d) How easy is it to find the information you need within the HMIS system?

[1]Very difficult [2]Difficult [3]Medium [4]Easy [5]Very easy

e) To what extent do you find it easy get HMIS to do what you want?

[1]Very difficult [2]Difficult [3]Medium [4]Easy [5]Very easy

V. TIMELINESS-

a) To what extent does the HMIS enable you to complete your tasks in a timely manner?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

b) How well does the HMIS ensure that you receive timely updates and alerts regarding patient care?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

c) How quickly and efficiently can you access the information you need using the HMIS?

[1]Really slow [2]Slow [3]Moderate speed [4]Appreciably fast [5]Very fast and on time

d) How well does the HMIS support your ability to make timely and informed decisions regarding patient care?

[1]Very poorly [2]Poorly [3]Moderately [4] Good [5]Excellent

e) To what extent does the HMIS help to minimize delays and bottlenecks in the delivery of healthcare services?

[1] Never [2] Rarely [3] Almost half time [4] Frequently [5] Everytime

10) REFERENCES

- 1) Adoption of Health Management Information System (HMIS) among ESIC Healthcare Professionals in Southern Districts of Tamil Nadu: An Integrated Model
<file:///C:/Users/Hp%20Pavilion/Downloads/ojsadmin,+98.pdf>
- 2) Chaudhry B, Wang J, Wu S, Maglione M, Mojica W, Roth E, et al. (2006). Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care. *Annals of Internal Medicine*. 2006.p.742-52.
- 3) Hospital information systems: Measuring end user computing satisfaction (EUCS)
<https://www.sciencedirect.com/science/article/pii/S1532046412000391>
- 4) The acceptance level of Hospital Information Management System (HIMS) among the nursing officials working in a teaching hospital (method)
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8826790/>
- 5) Practo HLS HMIS Software
<https://www.practo.com/bhopal/hospital/bansal-hospital-bhopal>
- 6) Bansal hospital home page
<https://bansalhospital.com/>
<https://bansalhospital.com/about-bansal-hospital/>
- 7) Elhadi M, Al-Hosni A, Day K, Al-Hamadani A, Al-Toqi A, Al-Shamli N, et al. Review of Health Information Systems in Oman. *SQU Journal ForScience*. 2007.p.101-20
- 8) Kaye R, Kokia E, Shalev V, Idar D, ChinitzD. Barriers and success factors in health information technology: A practitioner's perspective. *Journal of Management and Marketing in Healthcare*. 2010.p.163-75.
- 9) Kivinen T, Lammintakanen J. The success of a management information system in health care - A case study from Finland. *International Journal of Medical Informatics*. 2013.p.90-7.

- 10) Effective utilization of Hospital Management Information System (HMIS) (Aravind eye case)

<https://www.iapb.org/news/effective-utilization-of-hospital-management-information-system-hmis/>

- 11) System development life cycle and its stages

<https://www.clouddefense.ai/blog/system-development-life-cycle#:~:text=What%20Are%20the%207%20Phases,testing%2C%20implementation%2C%20and%20maintenance.>

- 12) A case study of the application of the Systems Development Life Cycle (SDLC) in 21st Century Health Care.

Journal for Southern Association for Information System

<https://quod.lib.umich.edu/j/jsais/11880084.0001.103/--case-study-of-the-application-of-the-systems-development?rgn=main;view=fulltext>

- 13) Development of a tool for measuring and analysing computer user satisfaction.

<https://pubsonline.informs.org/doi/10.1287/mnsc.29.5.530>

- 14) Testing User Satisfaction Using End-User Computing Satisfaction (EUCS) Method in Hospital Management Information System (SIMRS)
(Case Study at the Regional Public Hospital dr. A. Dadi Tjokrodipo)

<https://www.iiste.org/Journals/index.php/JIEA/article/view/49554>

- 15) Hospital management Information System in Health Sector and Development in Turkey. (HMIS)

https://www.researchgate.net/publication/329450531_Hospital_Management_Information_Systems_in_Health_Sector_and_Development_in_Turkey

- 16) A proposed model and measurement instrument for the formation of IS satisfaction: the case of end-user computing satisfaction

<https://www.semanticscholar.org/paper/A-proposed-model-and-measurement-instrument-for-the-Chin-Lee/be78f78b9fb5fe147978c08e0ff4446353825fb7>