Internship Training

At

Rajiv Gandhi Cancer Institute and Research Center

(February 7- May 7, 2023)

A Report on

Study on post implementation evaluation of health information system implemented in a cancer hospital in Delhi

By

KRITIKA SINGH

Enroll No. PG/21/050

Under Guidance of

Dr. Anandhi Ramachandran

PGDM (Hospital & Health Mangement)

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(Completion of Dissertation from Rajiv Gandhi Cancer Institute and Research Center)

The certificate is awarded to

Kritika singh

in recognition of having successfully completed his/her Internship in the department of

Information Technology Department

and has successfully completed his/her Project on

Study on post implementation evaluation of health information system implemented in a cancer hospital in Delhi

From: 7th February to 7th May 2023

At

Rajiv Gandhi Cancer Institute and Research Center, Rohini, New Delhi

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning.

We wish him/her all the best for future endeavors.

Sr. Manager

Zonal Head-Human Resources

Training & Development

Dissertation Writing

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Kritika Singh** student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone internship training at **Rajiv Gandhi Cancer Institute and Research Center Rohini New Delhi** from **7th of February to 7th of May**.

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

The Internship is in fulfillment of the course requirements.

I wish him all success in all his/her future endeavors.

Dr. Sumesh Kumar

Associate Dean, Academic and Student Affairs

IIHMR, New Delhi

Mentor

IIHMR, New Delhi

Certificate of Approval

The following dissertation titled "**Study on post implementation evaluation of health information system implemented in a cancer hospital in Delhi**" is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned does not necessarily endorse or approve any statement made, opinion expressed or conclusion is drawn therein but approves the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

Name EKTA SAROHA

Signature 

Certificate from Dissertation Advisory Committee

This is to certify that Ms. Kritika singh, a graduate student of the PGDM (Hospital & Health Management) has worked under our guidance and supervision. She is submitting this dissertation titled "**Study on post implementation evaluation of health information system implemented in a cancer hospital in Delhi** at Rajiv Gandhi Cancer Institute and Research Center in partial fulfillment of the requirements for the award of the PGDM (Hospital & Health Management).

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

Dr. Anandhi Ramachandran

Professor

IIHMR New Delhi

Dr. J.P. Dwivedi

Chief information officer

RGCI New Delhi

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **Study on post implementation evaluation of health information system implemented in a cancer hospital in Delhi** and submitted by **Kritika Singh** Enrollment No. PG/21/050 under the supervision of Dr. Anandhi Ramachandran for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from 7th February to 7th May, 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.

Kritika Singh

Signature

Acknowledgement

I hereby take this opportunity to thank Mr.JP Dwivedi (CIO) for giving me the opportunity to do my Internship in RGCI, Rohini and involving me in the project. I would also like to express my thanks to Mr. Deepak chouhan Mr. Verendra Sharma, Mrs. Priyanka Singhla, Miss sonali. Mrs. Sarita, Mr. Himanshu for their valuable input. Besides, I want to specially thank Senior management of RGCI who granted me full access to all the departments and resources of the organization. all the staff who sincerely co-operated in my entire Internship period. Finally, my sincere thanks to my professor Dr. Anandhi Ramachandran and My Internal mentor in IIHMR for their assistance and full support. Last but not the least, an honorable mention goes to my family and friends for their invaluable support.

Rajiv Gandhi Cancer Institute and Research Centre

Ref: HR/2023 **03/05/2023**

TO WHOMSOEVER IT MAY CONCERN

Rajiv Gandhi Cancer Institute and Research Centre is a premier 498 bedded (DHS Registration No. DGHS/NH/195) NABH, NABL accredited Super Specialty Institute providing comprehensive cancer care under one roof.

The Institute has been consistently ranked amongst India's Best Oncology Hospitals and has been the recipient of prestigious awards and recognitions including ranked amongst India's Top Ten Cancer Hospitals, in the Week – Nielsen Best Hospitals Survey 2014, India's Most Trusted Hospital for Oncology (Reader's Digest Most Trusted Brands 2016), National Business Leadership & Service Excellence Award 2017 for Best Oncology Hospital in India, Indywood Medical Excellence Award 2017 and Most Trusted Hospital in Oncology 2017 by India Today (Reader's Digest).

This is to certify that Ms. Kritika Singh, student of PGDHM, from IIHMR University, Delhi, has completed her 03 month's Internship in this Institute in the Department of Information Technology from 07th February 2023 to 07th May 2023. She has completed study on **"Post implementation evaluation of health information system implemented in cancer hospital in Delhi"**

During this period her performance and behavior was good.

We wish her all the best for her future endeavor.

Jeevan Singh
Senior Manager – HR

Vinay Agrawal
DGM - IT

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CERTIFICATE ON PLAGIARISM CHECK

Name of Student (in block letter)	Dr./Mr./Ms.: KRITIKA SINGH		
Enrollment/Roll No.	PGH/21/050	Batch Year	2021 - 2023
Course Specialization (Choose one)	Hospital Management	Health Management	Healthcare IT ✓
Name of Guide/Supervisor	Dr./ Prof.:		
Title of the Dissertation/Summer Assignment	STUDY ON POST IMPLEMENTATION EVALUATION OF HEALTH INFORMATIO SYSTEM IMPLEMENTED IN A CANCER HOSPITAL IN DELHI.		
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Similar contents acceptable (%)	Up to 15 Percent as per policy		
Total words and % of similar contents Identified	12%		
Date of validation (DD/MM/YYYY)	19/06/2023		

Guide/Supervisor

Name:

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Student

Name: Kritika Singh

Signature: Kritika Singh

Dean (Academics and Student Affairs)

Signature:

Date:

(Seal)

FEEDBACK FORM

Name of the Student: Kritika Singh.

Name of the Organisation in Which Dissertation Has Been Completed:
Rajiv Gandhi Cancer Institute and Research Center

Area of Dissertation: Attendance: 100% Satisfactory

Objectives achieved: Satisfactory.

Deliverables: Strengths: Good observer, Good learning abilities and keen to learn new things, Great communication skills, confident. Hard working leadership Qualities.
Suggestions for Improvement: NA

Suggestions for Institute (course curriculum, industry interaction, placement, Alumni): Satisfactory.

2/05/23

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

Date: 02/05/2023
Place: Delhi

Contents

Abbreviations and Keywords:

HIS: Health Information System

EMR: Electronic Medical Record

EHR: Electronic Health Record

PHR: Personal Health Record

HIE: Health Information Exchange

HIPAA: Health Insurance Portability and Accountability Act

HL7: Health Level Seven International

IHE: Integrating the Healthcare Enterprise

DICOM: Digital Imaging and Communications in Medicine

PACS: Picture Archiving and Communication System

RIS: Radiology Information System

CPOE: Computerized Physician Order Entry

CDSS: Clinical Decision Support System

PMS: Practice Management System

LIS: Laboratory Information System

CCD: Continuity of Care Document

CDA: Clinical Document Architecture

FHIR: Fast Healthcare Interoperability Resources

SNOMED CT: Systematized Nomenclature of Medicine -- Clinical Terms

LOINC: Logical Observation Identifiers Names and Codes

UMLS: Unified Medical Language System

API: Application Programming Interface

UI: User Interface

OPD: Out patient Department

MRD: Medical Record Department

Executive summary

Title:

"Study on post implementation evaluation of health information system implemented in a cancer hospital in Delhi"

Background:

Hospitals require effective information management for efficient and effective service, which is achieved through a Hospital Information System (HIS). Implementing new clinical or non-clinical systems poses challenges that affect every aspect of an organization. Therefore, strong leadership with a long-term outlook is essential. The benefits of HIS include improved healthcare standards, low medical errors, quality healthcare, and increased life expectancy. Healthcare transformation requires synergies between people, processes, and technologies. The process of running healthcare organizations and information systems is critical to achieving development, with computerized HIS marking advancements in both information technology and medicine

Objective:

To identify the gaps in technical requirements of the existing Hospital Information System (HIS) through post-implementation evaluation.

Methodology:

The aim of this study is to conduct a cross-sectional analysis of the Outpatient Department (OPD) using secondary data from MIS reports over a period of three months from February 7th, 2023 to May 7th, 2023, and existing feedback from stakeholders collected through a checklist. The study will be conducted using observation methods and secondary analysis. No direct interviews will be conducted. The study area will be limited to the OPD, and the data will be of a secondary nature.

Findings:

Results indicate that Designing a user-friendly, secure, cost-effective, and compliant HIS that considers all user needs, provides appropriate training and support, and ensures regular maintenance and updates is essential for ensuring its success. Ethical considerations should also be taken into account to protect patient rights.

Probable Outcome of the Study:

The expected outcome of the study is identification of the gaps in HIS with respect to the communication and sharing of information, performance, security, acceptability of HIS. It is also expected that based on these findings, new requirements can be identified that can form the basis for further improvement in the system.

Background

Hospitals are intricate businesses with high information requirements. Higher service effectiveness and efficiency levels depend on good information management within hospitals. HIS is a must for the current hospital infrastructure. Hospitals are said to need HIS in order to give high-quality care effectively.

A HIS is a thorough and integrated information system created to store, manage, retrieve, and utilise data related to the operational and clinical elements of a hospital.

Both computer-based and paper-based information processing are included in this. Computerised hospital information systems are the subject of this study.

The healthcare sector is undergoing a technological transformation. The goal of these transformational endeavours is to replace manual processes—often built on outdated methods—with technology-enabled or even automated ones. A commitment to managing change is absolutely necessary because the overall effort required for such a transition disrupts every part of the organisation to an extreme degree.

Clinical and cultural change in healthcare today has a wide-ranging, deep impact. A healthcare organization's clinical and technical departments must work together, which calls for new governance and organisational frameworks.

The transition has multiple dimensions and has ramifications for medicine, clinical practise, and culture.

To facilitate the implementation of clinical technology, efforts are concentrated on identifying and implementing best-practice, evidence-based processes on the medical and clinical sides. On the cultural front, the clinical transformation initiatives call for healthcare organisations to collaborate, assembling teams of medical professionals, nurses, chemists, ancillary care providers, and IT staff to question current practises. New care processes and practises, as well as data standards and integrity that better support a patient-centric approach to care, are the outcomes of such collaboration. These advancements will guarantee carer productivity, patient safety, high-quality care, workflow efficiency, timely and efficient care, and timely and effective treatment.

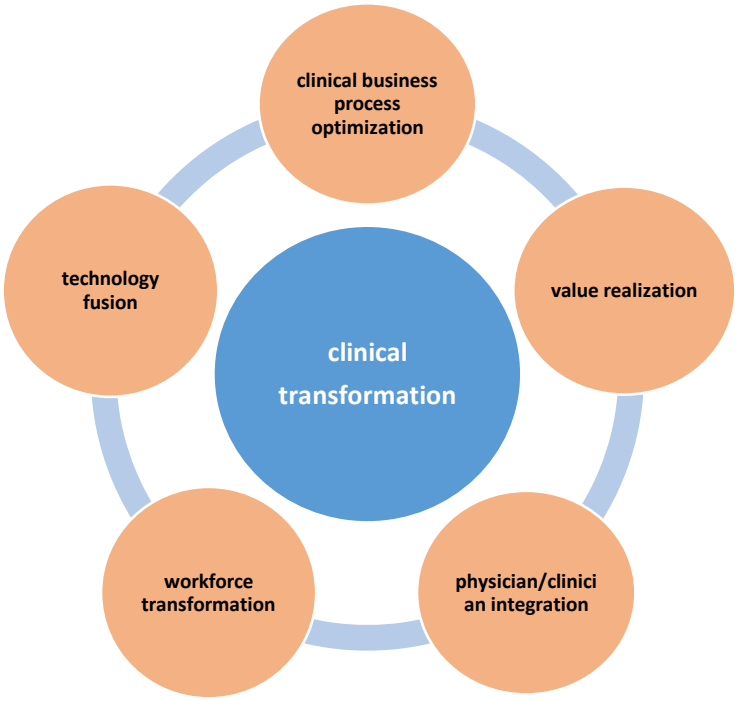
The whole effort causes enormous disruption to every element of the organisation, necessitating a commitment to managing change at every stage of the process.

Due to the extensive and all-encompassing nature of this clinical and cultural transition, organisations must develop new organisational and governance frameworks that promote collaboration between clinical and technical fields. Organisational transformation committees, teams, and structures must assure the following for success:

- Leadership alignment at the senior executive level, including board-level support
- Participation of multi-disciplinary end-user work teams
- Sponsorship by clinical, operational and physician leaders
- Facilitation from IT personnel.

The components of clinical transformation follow the methodology and include:

- **Clinical and Business Process Optimization** – reducing variation, improving efficiency and optimizing utilization in care delivery and administrative processes
- **Value Realization** – defining metrics, measuring, monitoring and realizing benefits for targeted processes
- **Physician/Clinician Integration** – the process by which physicians and other clinicians are engaged in the development, adoption, acceptance and accountability for care delivery processes
- **Workforce Transformation** – achieving change through communication, Governance/leadership, e-learning and knowledge management while focusing on Organizational culture
- **Technology Fusion** – the merging of technology and operational processes to achieve.



The purpose of this report is to evaluate the effectiveness of the health information system software currently being used by the hospital. The evaluation was conducted with the help of the IT department, and the findings are presented below.

Introduction

About Rajiv Gandhi Cancer Institute and Research Center

The Rajiv Gandhi Cancer Institute & Research Centre (RGCI & RC) is a leading cancer center in Asia, equipped with advanced technologies. It has received accreditation from NABH (National Accreditation Board for Hospitals and Healthcare) and NABL (National Accreditation Board for Testing and Calibration Laboratories). Established in 1994 under the Society Registration Act, the institute aims to provide comprehensive patient care while also conducting investigations on disease incidence, distribution, symptoms, and causes.

The institute commenced operations on July 1, 1996, with the opening ceremony performed by Smt. Sonia Gandhi. The formal inauguration took place on August 20, 1996, with the presence of dignitaries, including President Dr. Shankar Dayal Sharma. RGCI & RC offers a wide range of medical, surgical, and radiation treatments, employing a multidisciplinary approach led by super specialists who utilize tumor boards for critical second opinions. It is the largest cancer treatment facility in the country.

The outpatient services feature 57 consultation rooms and well-designed radiation therapy rooms spread across three floors. The institute also houses eight modular operating rooms, two minor operating rooms, surgical and medical intensive care units, and various supportive services, including renal replacement therapy. RGCI & RC has been recognized as one of India's top ten oncology hospitals and has received prestigious awards such as the Healthcare Achievers Award for Best Oncology Hospital in India.

The institute boasts specialized wards, including a dedicated leukemia ward, thyroid ward, and a pioneering bone marrow transplant unit. Renal replacement therapy, endoscopies, and other supportive services are also available. RGCI & RC has consistently been acknowledged as one of India's best oncology hospitals and has received accolades such as the National Business Leadership & Service Excellence Award and the Indywood Medical Excellence Award.

Notably, RGCI & RC has been recognized as the most trusted hospital in oncology by India Today (Reader's Digest) and has received various other awards and honors. The institute operates as a nonprofit organization, complementing government efforts in the healthcare sector.

About HIS paras

A fully integrated computer system was implemented in the hospital starting February 2003. The HIS is available on more than 400 terminals throughout the hospital. Hospital IT team worked in conjunction with HIS vendor, and was also responsible for communicating with and training the users. Clinical as

well as administrative applications were implemented.

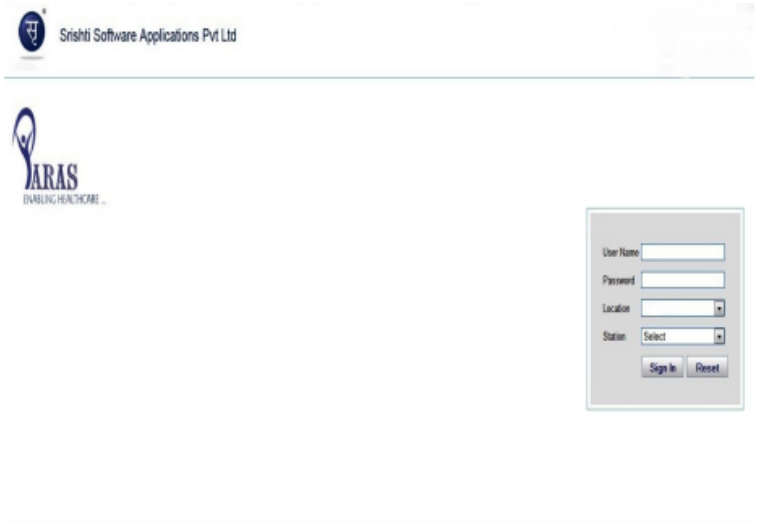


Fig.1 HMIS Login Page

Features of HIS:

1. Master Patient Index: This system maintains records of all registered patients at the hospital, including unique identification numbers, along with their demographic, financial, and medical information of long-term significance.
2. Duplicate Registration: This feature identifies potential duplicate records based on user-selected criteria, allowing for confirmation, merging, or removal of duplicate entries.
3. Patient File Management: This tool aids the Medical Records department in tracking patient folders across different departments, clinics, doctors, and external locations.
4. Appointment Scheduling Application: This application enables flexible scheduling of clinics and doctors, facilitating the booking of outpatient appointments, generating appointment slips/letters, and managing appointment confirmations, rescheduling, and cancellations.
5. Outpatient Management Application: This system handles the registration of outpatient visits for various clinics, supporting both walk-in and appointment-based visits. It allows for updating consultation and treatment information for the current visit and provides access to the patient's past history.
6. Inpatient Management Application: This application streamlines the processes of patient admission, transfer, and discharge, including bed booking. It assigns and manages ward/bed assignments, generates bar-coded labels and admission forms for proper patient identification.
7. Patient Billing Application: This comprehensive tool tracks and consolidates patient charges from registration to discharge, facilitating accurate billing processes.

8. Accounts Receivable Application: This application tracks receivables from debtors, managing receipt records, journal entries, and automating the production of reminders and account statements.
9. Order Entry Application: This system manages requests from wards, clinics, and departments for various services. Results can be entered using word processing capabilities or accessed from relevant modules, including interfaces with analyzers.
10. Laboratory Application: This application supports patient specimen registration, verification, test result recording, release, and review. It handles various result types and interfaces with patient billing. It also communicates with different models of analyzers, automating specimen requests and result downloads.

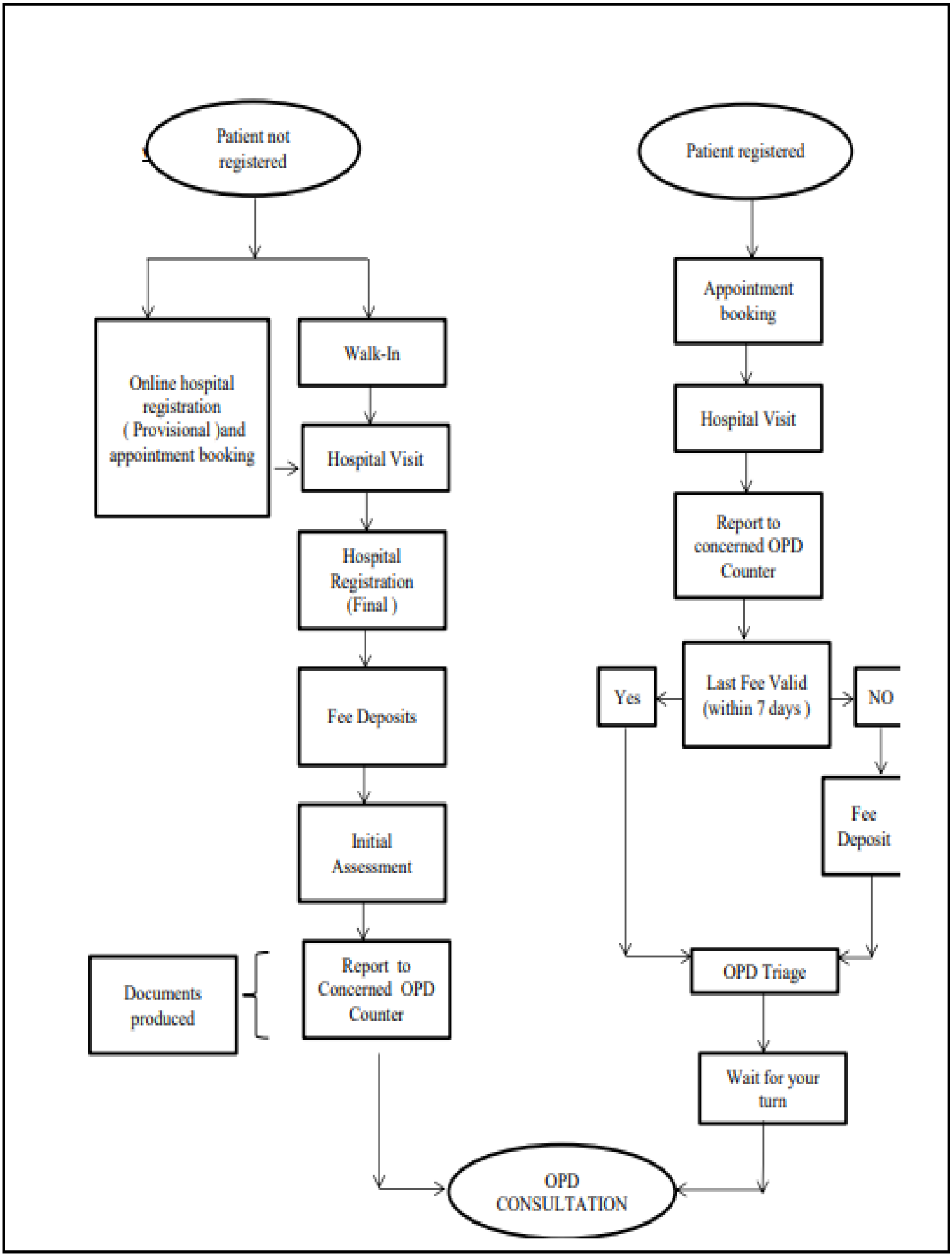
Following are the HIMS integrated modules currently being used in the hospital:

1. Facilities Management
2. Contract Management
3. **Outpatients Registration, Billing & Collection**
4. Reception & In-Patients Management
5. Patient Billing and Collection Management
6. Procurement Management
7. Central Stores Management
8. Drug Store
9. Lab Information Services (LIS)
10. Radiology Information Services (RIS)
11. OT Billing
12. Ward Management
13. MRD Management
14. Financial Accounts Management (Includes Doctors Accounting)
15. HR & Payroll Accounting System
16. System Security & Administration

Out Patient Module

- All OPDs are well planned with adequate space and waiting area. Waiting areas are furnished with televisions and token display screens. Drinking water facility, male /female wash rooms and wash rooms for differently able patients/ attendants are present in all OPD floors.

Flow of the Patient In Out Patient Department


Patient not registered
Online hospital registration (Provisional)and appointment booking
Walk-In
Hospital Visit
Hospital Registration (Final)
Fee Deposits
Initial Assessment
Report to Concerned OPD Counter
Documents produced
Patient registered
Appointment booking
Hospital Visit
Report to concerned OPD Counter
Last Fee Valid (within 7 days)
Yes
NO
Fee Deposit
OPD Triage
Wait for your turn
OPD CONSULTATION

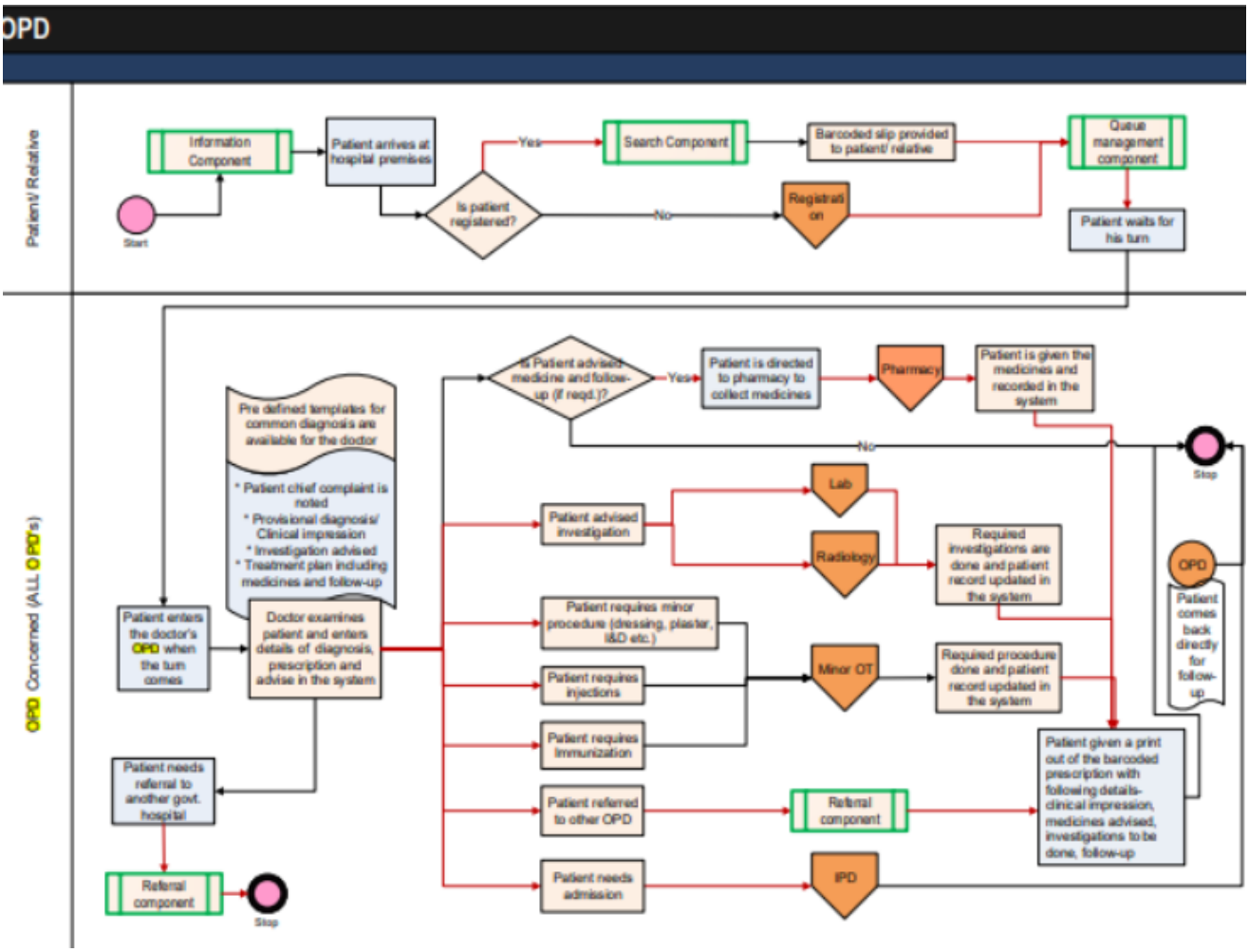
This process will help manage the OPD consultation in all healthcare facilities. OPD in primary and secondary care facilities shall follow a simple workflow after registration with or without the queue management. But in medium and large hospitals the flow of patients after registration must follow with proper sequencing using Queue Management system. Following process automation is required to be implemented:

- Patient visits the healthcare premises after getting relevant information
- For appointments, patients can seek online appointments through the web portal. The appointments can be taken from the next day onwards and not for the same day. Once the appointment is taken, a token number should be taken from the registration counter after biometric validation
- For OPD appointments, the same will be scheduled only for department and not for specific doctors
- After online appointment-patient will take queue number through a kiosk / counter, in the hospital before OPD consultation, after biometric verification / authentication
- The authorized operator at the Registration counter checks in the system if the patient is registered or not
- If the patient is registered, the authorized operator searches for his/her record and provide Token Number on the barcoded registration slip, having the Unique ID, Barcode and other details. The operator then directs patient to the relevant OPD
- If the patient is not registered, the authorized operator records the required registration details in the system and provides the barcoded registration slip to the patient with a token number mentioned on the same
- The digital registration record is automatically forwarded to the concerned OPD doctors' dashboard after patient registration is confirmed
- Patient waits for his turn according to the sequence / token number outside OPD doctors' room
- Patient enters the concerned OPD doctors' room when his/her turn comes and describes his/her ailment. The doctor examines the patient, checks his past record, if any, and enters the details of the clinical impression/ provisional diagnosis (based on ICD-10 coding), advised investigations, and medicines and follow-up (if any) in the system
- The Patient if requires any investigations, the details are selected by the concerned doctor and the system sends the corresponding details to respective departments
- The relevant investigation reports would be available for printouts to be provided to the Patient / Relative at the 'Registration Counter' and can be collected within the specified time period.
- If follow-up is advised without medicine, the Patient leaves. However, if follow-up is advised with medicine, the patient goes to Pharmacy. The patient takes prescribed medicines from the Pharmacy. Pharmacist / operator shall update the medicine details in the system as mentioned above. System deducts the corresponding medicines from the Inventory and maintains a digital register of the stock. The Patient then leaves.
- If minor procedure (dressing, plaster, I&D etc.), injection or immunization, the prescribed minor procedure, injection or immunization is selected from the list in the system by the operator. The system forwards the details to the respective departments'

dashboard. The patient then goes to the Minor OT room. The prescribed minor procedure, injection or immunization is done for the patient. The authorized Nurse /Paramedic updates the minor procedure details / status in the system. The System updates the corresponding articles from the Inventory and maintains a digital register for the stock. The Patient then leaves

- If investigation(s) is/are advised, the system forwards the details to the respective departments' dashboard. The patient then goes to the Lab/Radiology room. The patient undergoes prescribed investigation. The Lab/Radiology technician updates the investigation details/summary in the system. The Patient then leaves
- The patient may also take the printout of the investigation summary as entered by the Lab / Radiology technician, along with the original films, if any, from the Registration counter (report collection), after receiving the SMS alert
- If other OPD referral is/are advised, the patient goes to the designated room. The patient undergoes prescribed OPD diagnosis. The operator at the other OPD room updates the treatment summary in the system. The Patient then leaves after going through the required procedure
- If the patient is advised to be admitted, then patients' physical case file is forwarded to the admission counter with unique ID attached to it, where the operator completes the admission formalities in the system. The presiding Nurse allocates a bed in the respective ward. The presiding nurse in IPD updates the details in the system, based on the physical case file received, and the treatment in IPD, which continues as required
- If the patient needs referral, then patient file is updated, and patient is transferred to higher medical Centre for further treatment. The patient is provided with the printout of the 'Case file'/'Discharge Summary'before discharge from the hospital, as per details recorded in the system by the concerned operator
- Provisional diagnosis / Clinical impression will be using ICD-10 coding.
- In case the patient requires admission, the bed availability will be made visible to the doctor. If the situation allows, the doctor may counsel the patient for admission. Else, the same may be done at the admission desk. In cases, the beds are not available, the patient can be referred to another facility.
- In case the patient is being seen by more than one doctor / specialty, the printout of the prescription can be provided to him/her at the last specialty / department visited. The process will have the provision such that, if the patient wishes to have individual prescription print out of each visit done, the same can be done
- Doctor will have option to create patient prescription which will have patient complaint, History, Allergy, Comorbidities, Diagnosis, medicine order, investigation orders and other orders etc.
- Patient can be referred into inter, intra and to other specialty hospitals as and when required from doctor desk while consultation.
- All drugs as per the essential drug list will be provided free of cost to the patients.
- Pharmacist will be able to dispense medicine against prescription. Pharmacist will be able to dispense full medicine or partial medicine against order as per availability of the medicine.

To be process:



HIMS will have a dedicated module that will cover the services and functionalities of Outpatient.

- Pre-Registration/Online Appointment Module
- Registration Module
- Revisit

User Profiles to be created

- Patients – Patient will have access to mobile app and patient portal for getting online appointment. They will be able to enter demographic details and select specialization and date for consultation visit.
- Front Desk Operator: Front desk operator is responsible for registering and revisit of patient, The digital registration record is automatically forwarded to the concerned OPD doctors' dashboard after patient registration is confirmed

Hospital OPD Timings – Hospital OPD timing and doctor schedule can be configured as per hospital policy.

Online Appointment/Pre-Registration by patient through mobile app or patient portal:

- This functionality will allow the patients to make online appointment.
- Software will assign temporary OPD number for new patient's appointment.
- Appointment scheduling will be done as per doctor's availability.
- System has the provision to display the specialty wise schedule.
- The following parameter will be captured during pre-registration
  a. Title
  b. First Name
  c. Last Name
  d. Gender
  e. Age
  f. Nationality
  g. Religion
  h. Mobile Number
  i. Address
  j. Date & Time of Appointment
  k. Specialty

Appointment by front desk operator

- This module will allow the user to make appointment for old and new patients.
- Software will assign temporary OPD number for new patient's appointment.
- Appointment scheduling will be done as per doctor's availability.
- Software will provide the option to block specific slot/time in doctor's calendar so appointment will not be allowed for specific time slot. It will help to manage doctor's conference and meetings/non-availability.
- Staff can reschedule or cancel appointment as per patient's request and doctor's unavailability.
- Only patients having an appointment will be listed in the doctor's dashboard under waiting list for further activity like capturing patient history, diagnosis, pharmacy order, lab order etc.
- System has the provision to generate the report of the appointment data for a specific period. The report can be generated based on doctor or patient by selecting desired the date range.
- System has the provision to display the doctor's schedule.

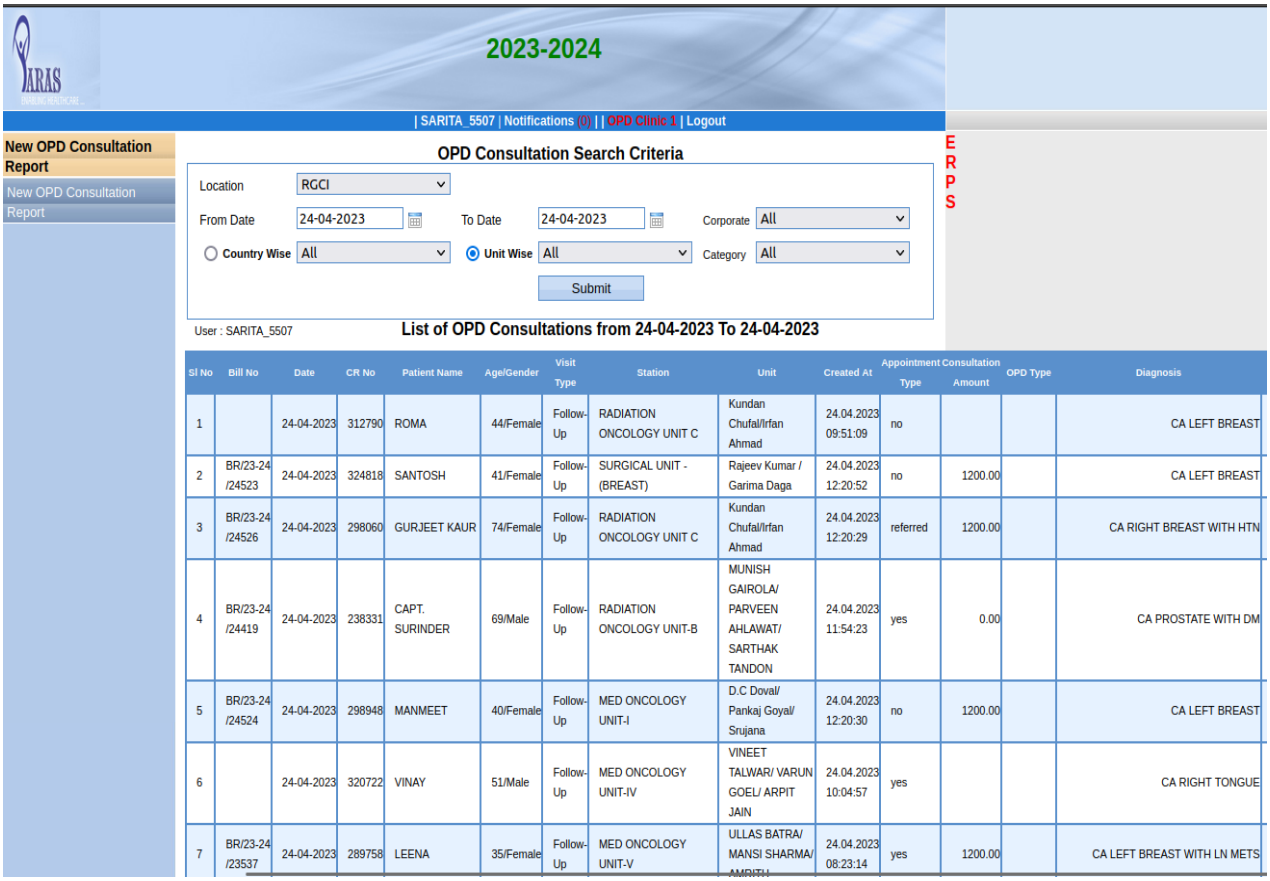
Registration:

- The pre-registration data will be automatically be retrieved upon entering the pre-registration number or through Bar Code scanning by Registration desk operator, and the system will allow search of the registration record using unique pre-registration number.
- Once registration is complete at the Registration desk, which should also involve capturing the patient's facial recognition and biometric, the patients may proceed to avail required healthcare services.
- The registration process will be provisioned through any healthcare facility across Delhi. Its id further mandatory that the registration records will be validated and authenticated against the AADHAR database through UIDAI integration and AADHAR may use as one of the unique identifiers to search the patient in HIMS.
- Further it is important that the family tree of each patient is mapped using registration data, once
  registration of all concerned family members is completed. Till then all records should still be linked and available for search using Pre-Registration number.
- A patient OPD slip will be issued to the patient and subsequently, the system should automatically assign a token number for the day based on details entered in the system.
- The operator then directs the patient to the concerned doctor/ specialty for consultation.
- Software will capture following parameter during registration:
  - Capture patient photo
  - ID card
  - Title
  - First name
  - Last name
  - Gender
  - Age/DOB
  - Guardian name
  - Relation with patient
  - Marital status
  - Religion
  - Nationality
  - Mobile number
  - Email
  - Local address
  - Permanent address
  - Department
  - Room number

Revisit:

- The user can create the revisit for the existing patient by selecting specialty and room number along with unit selection.
- A patient OPD slip will be issued to the patient and subsequently, the system should automatically assign a token number for the day based on details entered in the system
- The digital registration record is automatically forwarded to the concerned OPD doctors' dashboard after patient registration is confirmed

- Patient waits for his turn according to the sequence / token number outside OPD doctors' room



Sl No	Bill No	Date	CR No	Patient Name	Age/Gender	Visit Type	Station	Unit	Created At	Appointment Type	Consultation Amount	OPD Type	Diagnosis
1		24-04-2023	312790	ROMA	44/Female	Follow-Up	RADIATION ONCOLOGY UNIT C	Kundan Chufal/Irfan Ahmad	24.04.2023 09:51:09	no			CA LEFT BREAST
2	BR/23-24/24523	24-04-2023	324818	SANTOSH	41/Female	Follow-Up	SURGICAL UNIT - (BREAST)	Rajeev Kumar / Garima Daga	24.04.2023 12:20:52	no	1200.00		CA LEFT BREAST
3	BR/23-24/24526	24-04-2023	298060	GURJEET KAUR	74/Female	Follow-Up	RADIATION ONCOLOGY UNIT C	Kundan Chufal/Irfan Ahmad	24.04.2023 12:20:29	referred	1200.00		CA RIGHT BREAST WITH HTN
4	BR/23-24/24419	24-04-2023	238331	CAPT. SURINDER	69/Male	Follow-Up	RADIATION ONCOLOGY UNIT-B	MUNISH GAIROLA/ PARVEEN AHLAWAT/ SARTHAK TANDON	24.04.2023 11:54:23	yes	0.00		CA PROSTATE WITH DM
5	BR/23-24/24524	24-04-2023	298948	MANMEET	40/Female	Follow-Up	MED ONCOLOGY UNIT-I	D.C Doval/ Pankaj Goyal/ Srujana	24.04.2023 12:20:30	no	1200.00		CA LEFT BREAST
6		24-04-2023	320722	VINAY	51/Male	Follow-Up	MED ONCOLOGY UNIT-IV	VINEET TALWAR/ VARUN GOEL/ ARPIT JAIN	24.04.2023 10:04:57	yes			CA RIGHT TONGUE
7	BR/23-24/23537	24-04-2023	289758	LEENA	35/Female	Follow-Up	MED ONCOLOGY UNIT-V	ULLAS BATRA/ MANSI SHARMA/ AMRITH	24.04.2023 08:23:14	yes	1200.00		CA LEFT BREAST WITH LN METS

Fig. OPD consultation search criteria

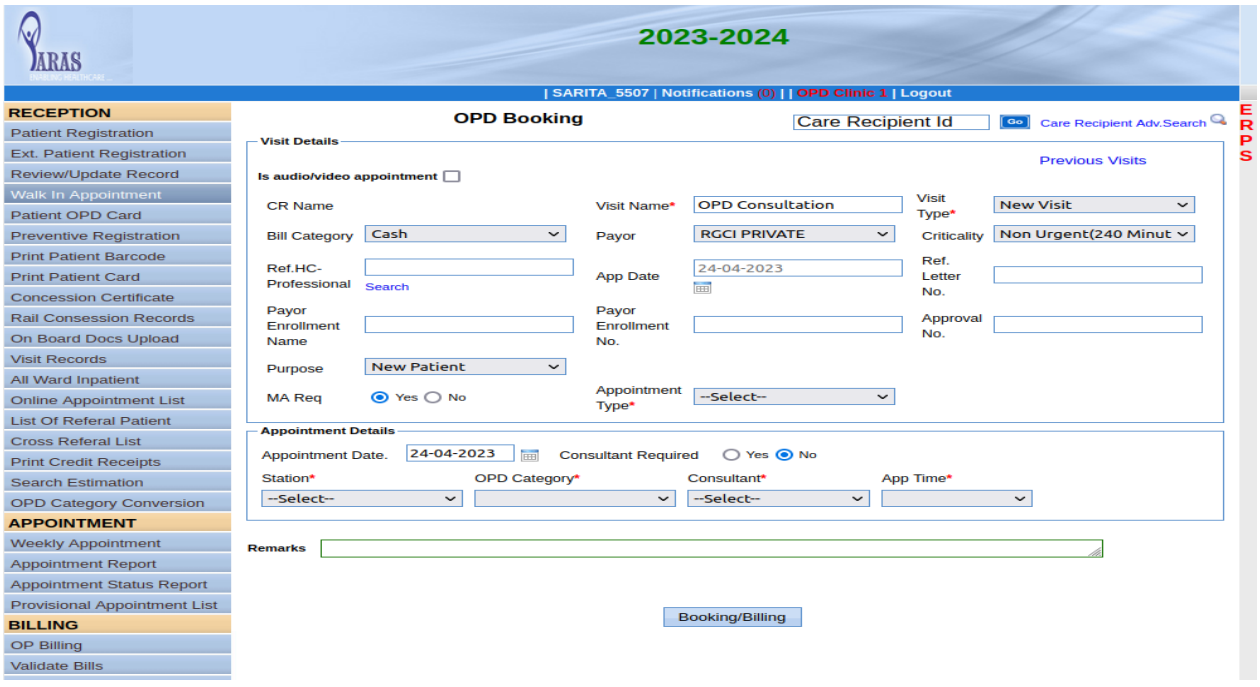
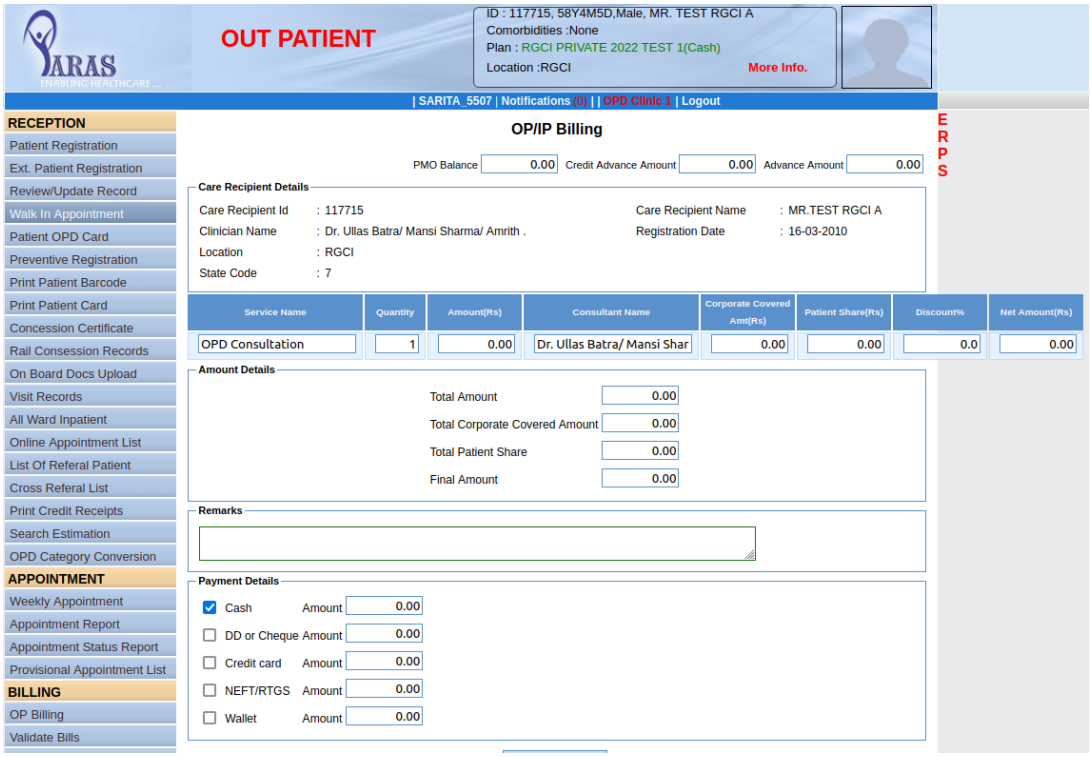


Fig. OPD billing



The system should provide the facility for OP billing as applicable. The system should calculate the line wise charges for each of the services required to be availed by the patient, like doctor's consultation, lab test, etc. and also the consolidated amount, as per defined government rates. The bill generated will be bar coded for easy reference and retrieval of data as required.

Currently all services, and medicines are free in Delhi, so the net payable amount in the OPbill should be mentioned as Nil/ Zero. However, the system should be flexible enough to allow modification in the rates / charges for individual healthcare services.

- Software will allow to make receipt for registration charges with 0 amount.
- Software will allow to raise bill for all kind of services, investigations, procedures etc with zero billing.
- Software will provide functionality to generate IPD final bill.
- Software will allow to make charge slip for all kind of services, room charges, investigations, procedures, surgeries, OT charges, doctor fee, supplies etc.
- Software will allow to configure bed charges as per hospital policy
- Software will have option to configure different tariff based on corporates and MOU signed.
- Software will allow discount approval on individual charge slip with one level approval by higher management.
- Discount can be given in percentage on final bill and accordingly discount value will be equally distributed on whole bill.
- Advance can be taken against patient ID.

- Advance amount will be adjusted in final bill.
- Software will allow to make provisional bill.
- Different pay mode will be available like cash / credit/ cheque etc.
- Software will allow to make cash/credit bills based on patient entitlement.

Literature Review

- This study evaluated the qualitative and quantitative performances of a newly implemented information system at National Health Insurance Corporation Ilsan Hospital. The results showed significant improvements, including a 20% reduction in registration waiting time and a 15% reduction in waiting time at the internal medicine department. The economic analysis revealed a benefit-to-cost ratio of 1.34 when considering all intangible benefits. The study concluded that the new system had positive economic and performance-related benefits, but further research is needed to assess long-term stability and impact. Overall, the study provides evidence of the system's positive effects on hospital operations, patient waiting times, and economic outcomes, emphasizing the potential for improving healthcare services.
- This study evaluated the performance and economic feasibility of the information system implemented at Pusan National University Hospital (PNUH). The system was designed using component-based development and internet technologies, with specific components developed for various functionalities. The qualitative evaluation based on the performance reference model indicated reasonably high performance levels overall. The economic analysis showed increasing benefit-to-cost ratios over time, indicating improved economic profitability. However, doctors expressed lower satisfaction with the system, possibly due to weak clinical functionality. The study highlights the importance of further evaluation and improvement, particularly in clinical aspects, to enhance satisfaction and system performance.
- This study focused on the implementation of a consolidated hospital information system at Seoul National University Hospital and aimed to highlight its advantages. The study found that the system, comprising various component applications, led to significant improvements in healthcare quality and hospital management efficiency. Clinical information systems supported clinical activities, while the clinical research support system provided valuable resources for clinical operations. The hospital aims to further enhance the system, enabling customized healthcare services and meeting individual requirements, with the current information strategy serving as a foundation for developing a next-generation system. The ultimate goal is to provide enhanced care and improve overall healthcare delivery at Seoul National University Hospital.
- This review aimed to identify effective educational strategies and approaches for enabling healthcare providers to optimize their use of a Health Information System (HIS). The researchers conducted a systematic review of relevant studies and analyzed the findings using a qualitative thematic analysis approach. Out of 3,539 screened studies, 17 were included for data extraction. The results emphasized the importance of engaging and understanding learners within the clinical context, facilitating the transfer of learning to patient care, and implementing continuous evaluation to address evolving clinical demands. The review supports the development of a new HIS learning framework that can guide the design and

development of HIS education for healthcare organizations. Future research should focus on translating this framework into practical implementation.

Rationale

In today's world, digital transformation has become a necessity for every industry, including healthcare. In the healthcare industry, the implementation of Hospital Information Systems (HIS) is a vital step in the digital transformation process. Once a hospital implements an HIS, it is crucial that the system operates smoothly without interruption. This seamless operation of the HIS allows the hospital to access a wide range of data, including patient demographics, admission, discharge, and transfer information, laboratory test results, and much more.

After the implementation of the HIS, it is essential to evaluate the system's performance to identify any gaps between the provided features and user requirements, operational issues, new requirements raised by the end-users, and the system's efficiency. The post-implementation evaluation process can help the hospital to optimize the HIS according to its specific needs.

To ensure that the HIS operates efficiently, it is essential to consider the technical requirements of the system. System performance, communication and sharing of information, security, user-friendliness, and acceptability by the end-user are all factors that should be considered.

In a recent study, post-implementation evaluation was carried out on a 500 bedded tertiary oncology hospital in Delhi that had recently implemented an HIS. This evaluation aimed to identify any gaps between the provided features and user requirements, operational issues, and new requirements raised by the end-users. The study also aimed to assess the efficiency of the system and the level of acceptability by the end-users.

The results of the study showed that the HIS implementation had positively impacted the hospital's operational efficiency. The HIS had improved the hospital's overall workflow, reduced the time required for manual data entry, and improved the accuracy of data. However, the study also identified some gaps between the provided features and user requirements that needed to be addressed.

To address these gaps, the hospital took several measures, including modifying the HIS to meet specific user requirements, providing additional training to end-users, and improving communication channels between the hospital staff and the HIS development team. These measures helped to enhance the efficiency of the system and improve the overall user experience.

In conclusion, the implementation of HIS in hospitals is a critical step towards achieving digital transformation in the healthcare industry. However, it is essential to ensure that the system operates smoothly and efficiently to provide comprehensive data access to the hospital staff. Post-implementation evaluation plays a crucial role in optimizing the HIS to meet the specific needs of the hospital and its end-users.

Research Question

How can post-implementation evaluation be utilized to identify gaps in technical requirements of Health Information Systems (HIS)?

This research question aims to investigate the use of post-implementation evaluation as a method to identify technical requirements gaps in HIS. The study intends to explore the effectiveness and useability and provide insights into how it can be used to improve the overall quality and functionality of HIS.

To answer this research question, the following sub-questions could be considered:

1. What are the key workflow processes within the existing Hospital Information System (HIS) in the tertiary cancer care hospital?
2. What are the identified gaps in the technical requirements of the existing HIS?
3. How do stakeholders perceive the impact of these identified gaps on the efficiency and usability of the system?
4. What strategies can be recommended to address the identified gaps and improve the overall functionality and performance of the HIS?

The study will employ a mixed-methods approach, combining qualitative and quantitative data collection and analysis methods, to gather data from HIS stakeholders, including end-users, IT professionals, and healthcare providers. The findings of the study will contribute to the development of a framework for utilizing post-implementation evaluation to identify technical requirements gaps in HIS, which can inform the design and implementation of more effective HIS systems in the future.

Objective

The objective of this study is

Primary Objective

To identify the gaps in technical requirements of the existing Hospital Information System (HIS) through post-implementation evaluation.

Specific Objectives

- To understand the workflow of the existing HIS in the tertiary cancer care hospital and identify gaps
- To analyze the perception of the stakeholders regarding the impact of identified gaps on the efficiency and usability of the system.
- Based on the above recommend strategies for addressing any identified gaps to improve the overall functionality and performance of the HIS.

Evaluation Methodology:

Here's a detailed breakdown of the methodology for the study:

- **Study Design:** The study was designed as a cross-sectional study. This study design allowed for the collection of data at a single point in time, providing a snapshot of the current state of the OPD patient care service staff and executives' perception of the PARAS Healthcare Information System (HIS).

- **Study Area:** The study was conducted in the OPD area of RGCI (Rajiv Gandhi Cancer Institute) located in New Delhi, India. The OPD area of this healthcare facility was chosen as the setting for the study.

- **Duration of the Study:** The study was conducted over a period of 3 months, specifically from 7th February 2023 to 7th May 2023. This timeframe allowed for sufficient data collection and analysis.

- **Type of Data:** The data used in this evaluation was secondary data. The researchers utilized existing feedback gathered from stakeholders through a checklist and an Management Information System (MIS) report. The feedback and data were already available from previous interactions with the stakeholders.

- **Sampling Size:** The sample size for this study was 25 participants. This sample size represents the OPD patient care service staff and executives who actively use the PARAS HIS at the healthcare facility.

- **Sampling Technique:** Convenience sampling was employed in this study. This sampling technique was chosen due to the easy accessibility of the available samples. The researchers distributed a structured questionnaire through an online platform (Google Forms) to conveniently and efficiently collect data from the participants.

- **Study Population:** The study population consisted of the end users of the PARAS HIS, specifically the OPD patient care service staff and executives at RGCI, New Delhi. These individuals were actively engaged with the HIS system in their daily work.

- **Selection Criteria:**
    - **Inclusion Criteria:** The inclusion criteria for the study included OPD patient care service providers and executive staff who actively used the PARAS HIS software in their work.

- **Exclusion Criteria:** The nursing staff who were not actively using the HIS software were excluded from the study.

❖ **Data Collection Tool:** A structured questionnaire was used as the data collection tool in this study. The questionnaire was designed to survey all the employees who used the PARAS HIS in OPD. The questionnaire included rating scales, specifically the Likert scale ranging from 1 to 5. The participants were asked to rate the effectiveness of the HIS in five components: sharing of information & communication, performance, security, user acceptability, and technical support.

❖ **Data Collection Procedure:** The structured questionnaire were distributed to the OPD patient care service staff and executives through an online platform, specifically Google Forms. The participants were requested to provide their ratings and feedback based on their experiences with the PARAS HIS. The collected data from the survey was then analyzed using descriptive statistics, such as calculating the mean, for each component of the evaluation.

❖ **Analysis of MIS Report:** In addition to the survey data, the researchers also analyzed the existing MIS report obtained from the healthcare facility. The MIS report contained relevant data related to the PARAS HIS usage, which was analyzed using Microsoft Excel to gather additional insights.

❖ **Ethical Consideration:** The study followed ethical guidelines to ensure the well-being and rights of the participants. The researchers obtained approval from the healthcare facility before conducting the study. The confidentiality of participant responses and collected data was ensured throughout the study. The aggregated results were presented in a way that maintained participant anonymity. The data collected was solely used for the purpose of evaluation and no personal identifiers were included in the analysis.

By following this methodology, the study aimed to assess the perceptions of the OPD patient care service staff and executives regarding the effectiveness of the PARAS HIS at RGCI, New Delhi.

Observations & Findings:

Based on the observation on the issues reported for OPD module of HIS are:

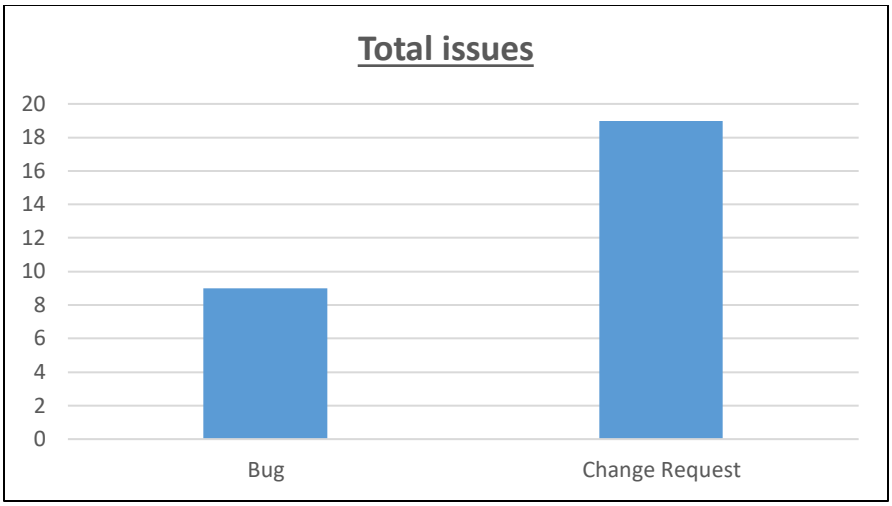


Fig.

Based on the statistics provided, it can be observed that there were a total of 28 issues reported under the HIS system. These issues were classified into two categories, namely bugs and change requests. Out of the 28 issues, 9 were classified as bugs, while 19 were classified as change requests. This suggests that change requests were more prevalent than bugs in the HIS system during the time period analyzed. Further analysis may be required to understand the nature and severity of these issues, as well as their impact on the overall performance and functionality of the HIS system.

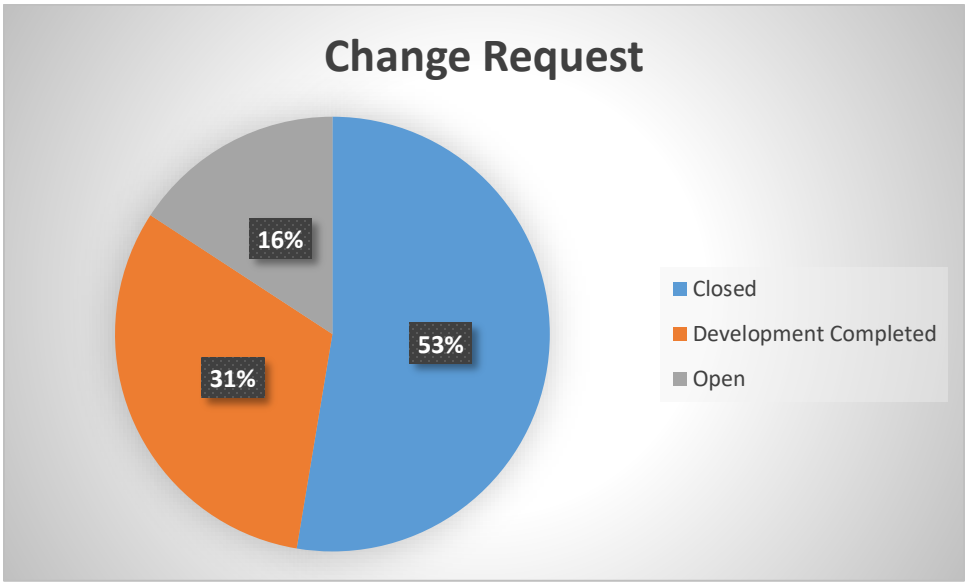


Fig.

Based on the provided statistics, we can make the following observations about the change request status:

1. Closed Request: This represents the percentage of change requests that have been resolved and closed, which is 53%. It can be inferred that the remaining requests are still open and being worked on.
2. Development and Completed Request: This represents the percentage of change requests that have been worked on and completed, which is 31%. This could include requests that have been completed but are yet to be closed.
3. Open Request: This represents the percentage of change requests that are still open and yet to be worked on, which is 16%.

Overall, the statistics suggest that a significant number of change requests are still open and being worked on, and only a fraction have been resolved and closed. It may be necessary to prioritize the open requests and allocate appropriate resources to ensure timely resolution of these requests.

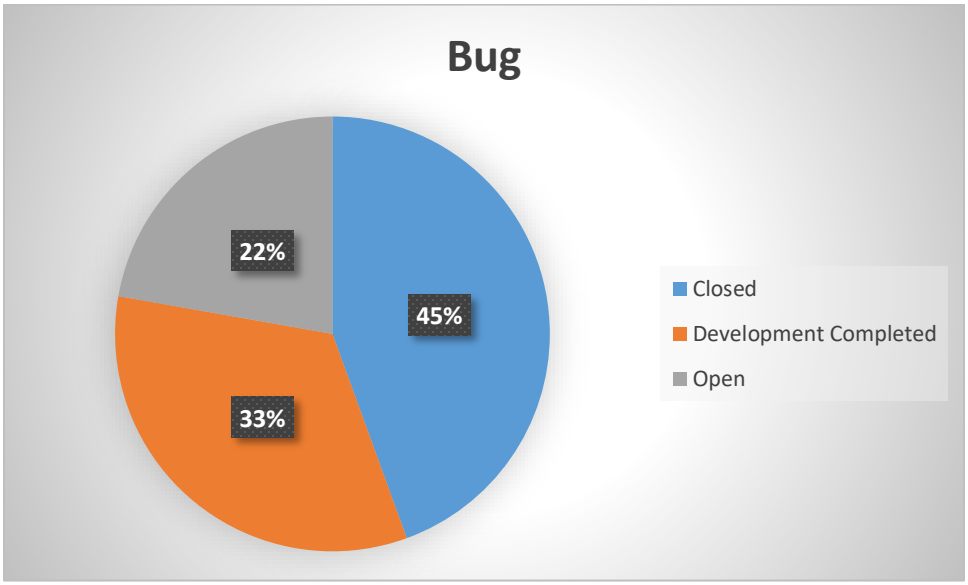


Fig.

Out of a total of 9 bugs reported, 45% bugs have been closed, indicating that they have been resolved and are no longer affecting the system. Additionally, 33% bugs have been marked as development completed, indicating that they have been resolved and are currently undergoing testing before being released to the users.

There are still 22% bug that remains open, indicating that it has not yet been resolved and is still affecting the system. This bug is likely to be under investigation or actively worked on by the development team. In total 5 bugs have been reported, closed, development completed or remain open. This indicates that the bug tracking and resolution process is ongoing and actively being managed by the development team.

Findings:

Sl No.	Link Name	Bug Description	Status	Priority
1.	Billing	For medi assistance GIPSA patient took 21% discount on the three items instead of 10%	Closed	Normal
2.	Billing	Please check the logs as amount covered by advance is coming wrong and OP billing is not correct	Closed	High
3.	Billing	User can able to do billing for expired patient	closed	High
4.	EMR	Create new separate tabs for IP notes and physicians referral on home screen	open	

Result:

The overall feedback analysis from the end user is as under:

Q1.

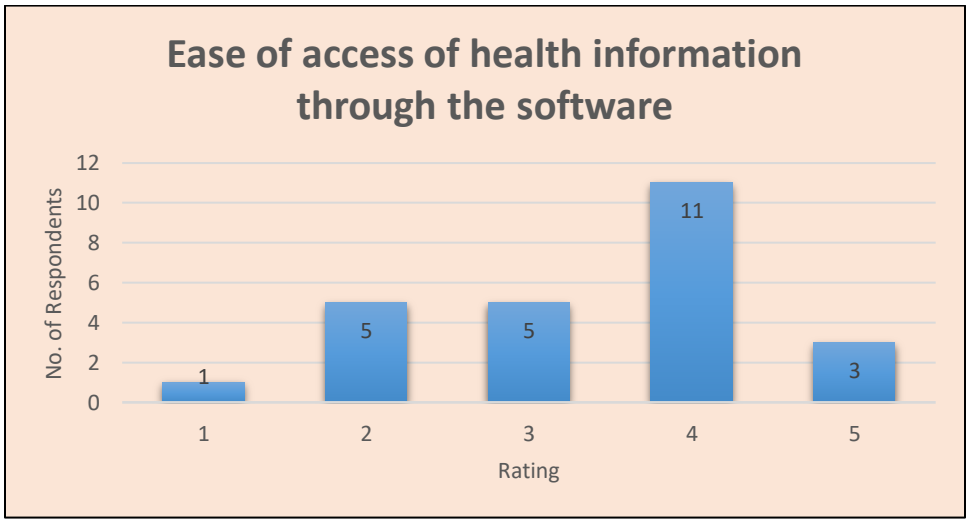


Fig.

Based on the statistics provided, we can conclude that the majority of users rated the ease of access of health information through the software as either 4 (44%) or 2 (20%). The lowest rating of 1 received only 4% of the responses while the highest rating of 5 received 12%. The rating of 3 received 20% of the responses.

Overall, the average rating for the ease of access of health information through the software would be approximately 3.4, which indicates that the software is generally perceived to be

moderately easy to access health information. However, it is important to note that there is a significant portion of users who rated the software lower than this average, which suggests that there may be room for improvement in terms of accessibility.

Q2.

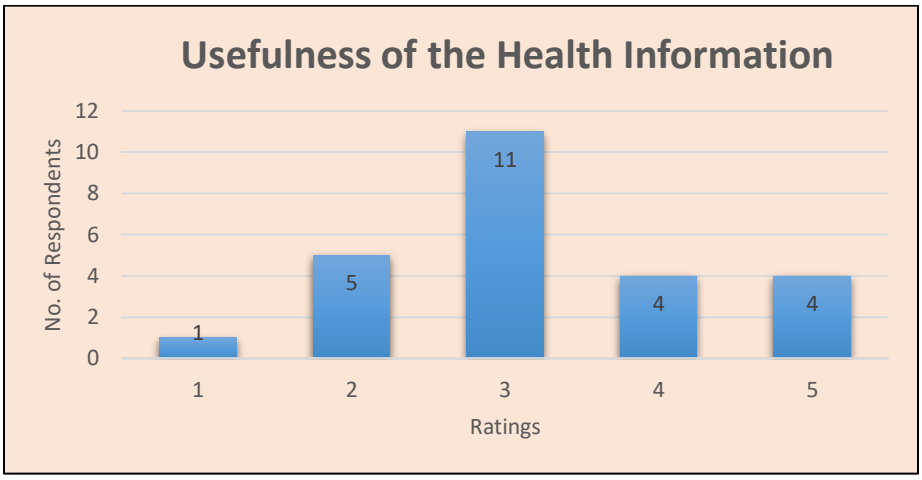


Fig.

The majority of the responses (11) 44% rated the usefulness of health information shared through the software as a 3 on a scale of 1 to 5. Only a small percentage of the responses (1) (4%) rated the usefulness as a 1, indicating that very few found the information to be not useful at all. The highest rating received was a 4 or 5, with both categories receiving 16% of the responses each. This suggests that a significant portion of users found the information to be quite useful, but not necessarily essential.

Overall, the results suggest that the software is perceived to be moderately useful for sharing health information with doctors and nurses, with most respondents indicating a neutral or slightly positive view. However, there is also room for improvement, as a significant percentage of respondents did not rate the software as highly useful.

Q3.

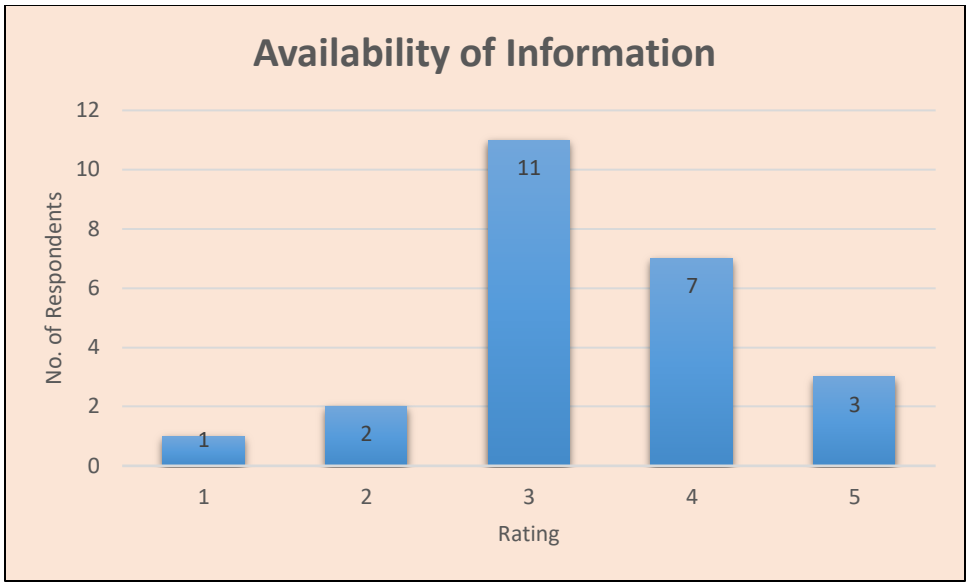


Fig.

The majority of respondents (11) 44% rated the availability of information in a timely manner as a 3 out of 5. Only a small percentage (4%) rated it as a 1 out of 5, while (3) 12% rated it as a 2 out of 5 or a 5 out of 5. The second highest percentage 28% (7) rated it as a 4 out of 5. Overall, the data suggests that there is room for improvement in terms of information availability in a timely manner, as the majority of respondents did not rate it as highly as possible.

Q4.

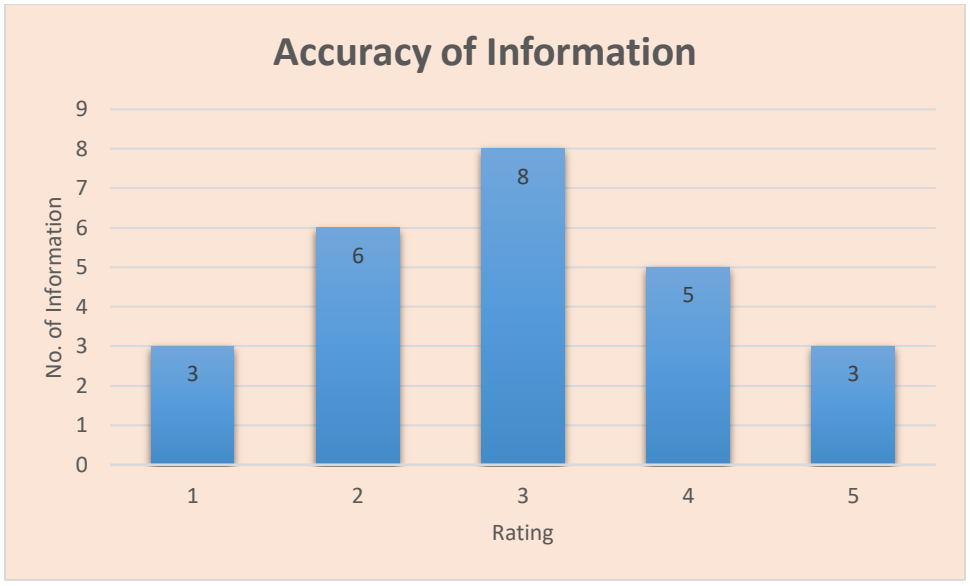


Fig.

Based on the statistical analysis of the accuracy of the information being shared, it appears that a majority of the information 32% (8) is rated as "average" with a score of 3 out of 5. 20% of the information is rated as "good" with a score of 4 out of 5, while only (3) 12% is rated as either "excellent" with a score of 5 out of 5 or "poor" with a score of 1 out of 5. The remaining 24% is rated as "below average" with a score of 2

out of 5. Overall, there is room for improvement in the accuracy of the information being shared, as nearly half of the responses (36% rated 1 or 2) are below average.

Q5.

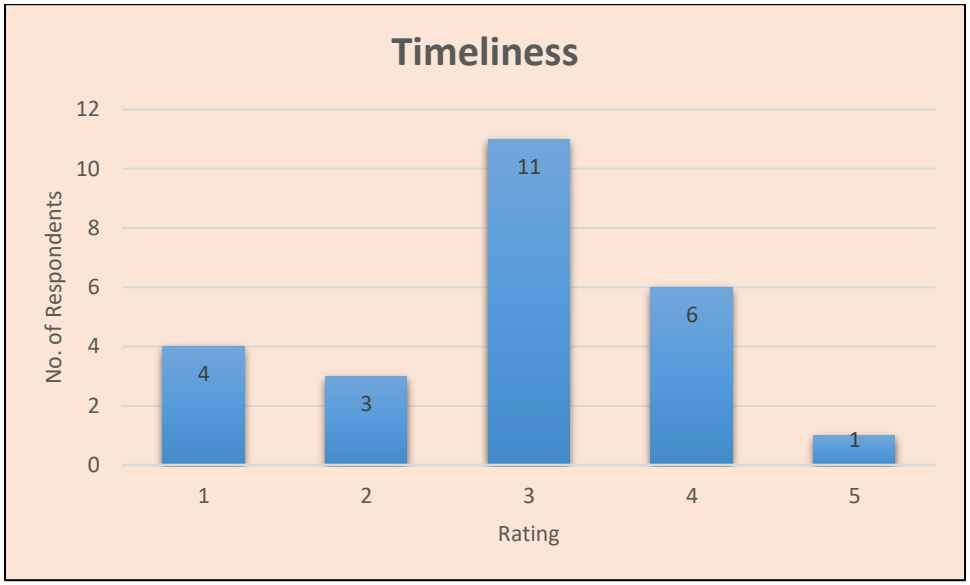


Fig.

Based on the statistical analysis, the majority of the information being shared is rated as "timely" with a rating of 3 out of 5, accounting for 44% of the responses. Only 4% of the responses rated the information as highly timely with a rating of 5 out of 5. On the other hand, 16% (4)of the responses indicated that the information being shared was not timely with a rating of 1 out of 5, while 12% rated it as somewhat untimely with a rating of 2 out of 5. Additionally, 24% (6) of the responses rated the information as fairly timely with a rating of 4 out of 5. Therefore, the overall trend suggests that the information being shared is generally perceived as timely, but there is room for improvement in some cases.

Q6.

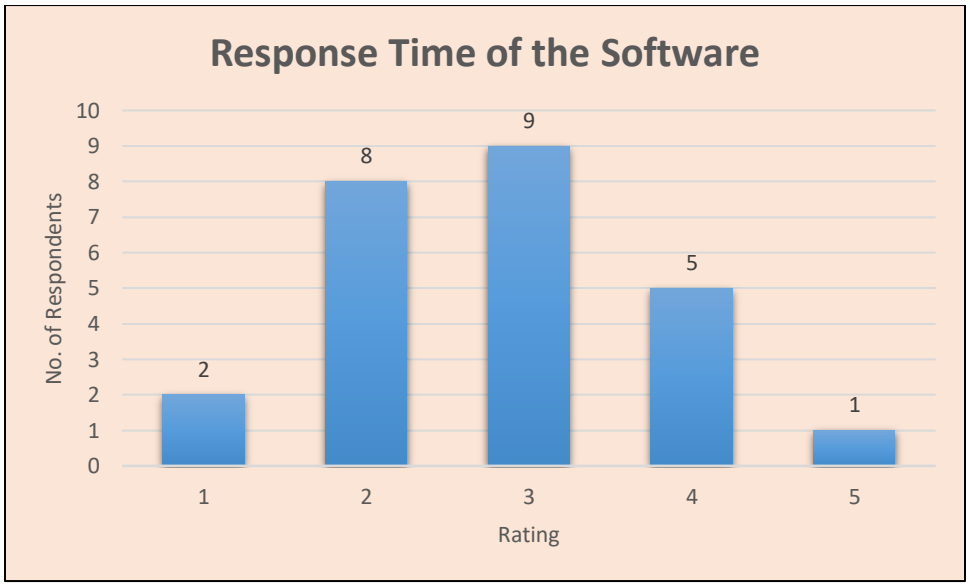


Fig.

These results suggest that the majority of the queries (68%) received a rating between 2 and 4, indicating an average response time of the software. However, 8% of the queries received the lowest rating of 1, indicating a very slow response time, while only 4% of the queries received the highest rating of 5, indicating a very fast response time. Therefore, there may be room for improvement in the software's response time for certain queries.

Q7.

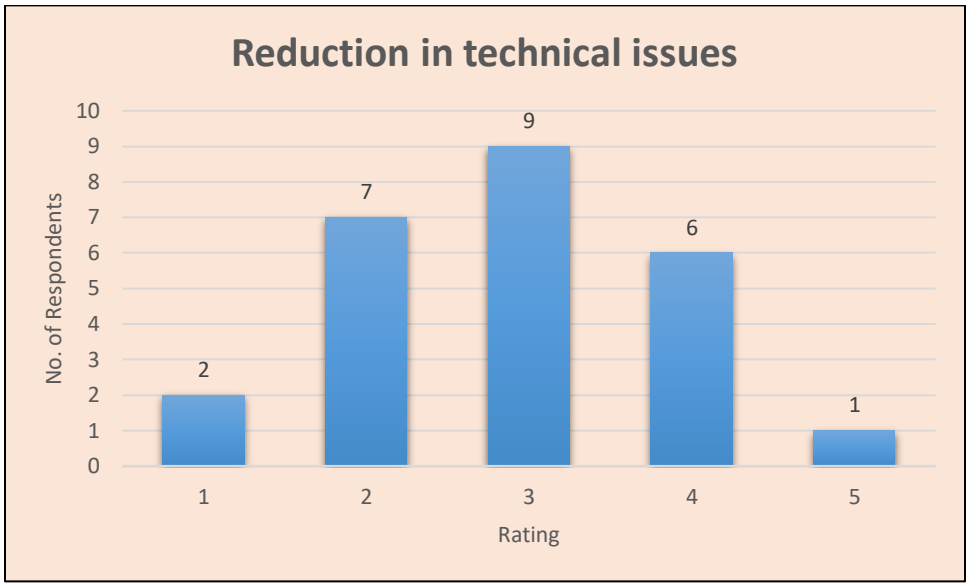


Fig.

The majority of the users experienced some reduction in technical issues, with the highest percentage of users rating it as 3, indicating a moderate level of improvement. However, there is still room for improvement, as a significant portion of users (32%) rated the reduction as 1 or 2, indicating that they did not see much improvement.

Q8.

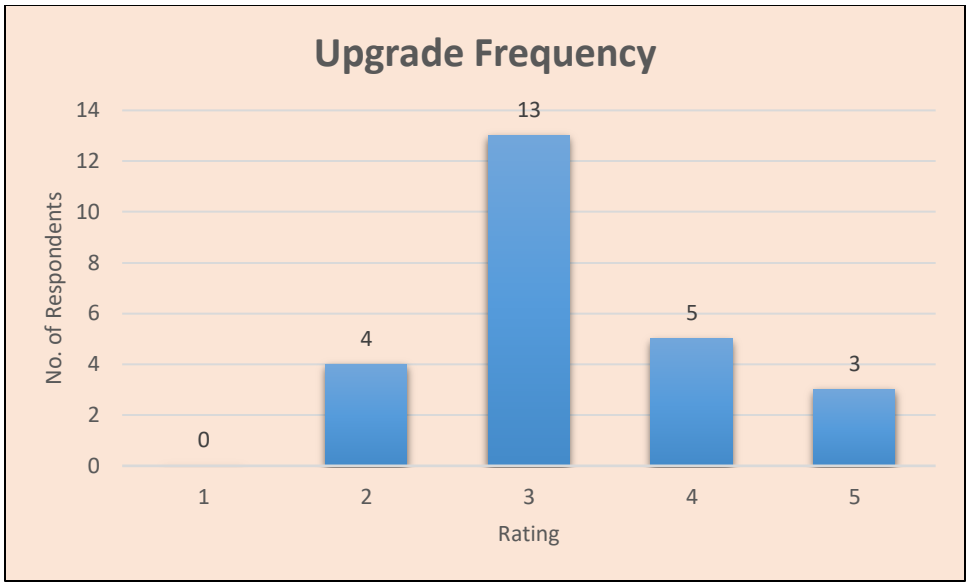


Fig.

A significant portion of respondents (16%) rated the upgrade frequency as "below average" with a rating of 2, while none of the respondents selected the lowest rating of 1. The statistical analysis suggests that the majority of users are generally satisfied with the upgrade frequency of the software, with a majority rating of 3, 4, or 5. However, the data also indicates that a notable minority of users feel that the frequency is below average, and may be in need of improvement.

Q9.

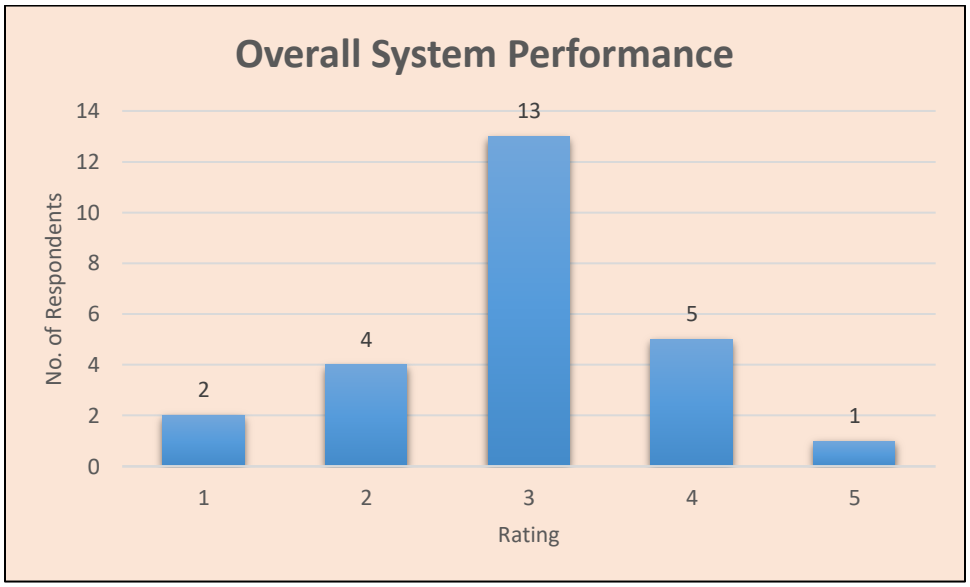


Fig.

Overall, the system performance can be considered moderately good, with a significant portion of respondents indicating that there is room for improvement. The distribution of ratings also suggests that the system performance is not exceptionally good or exceptionally bad, but falls somewhere in between.

Q10.

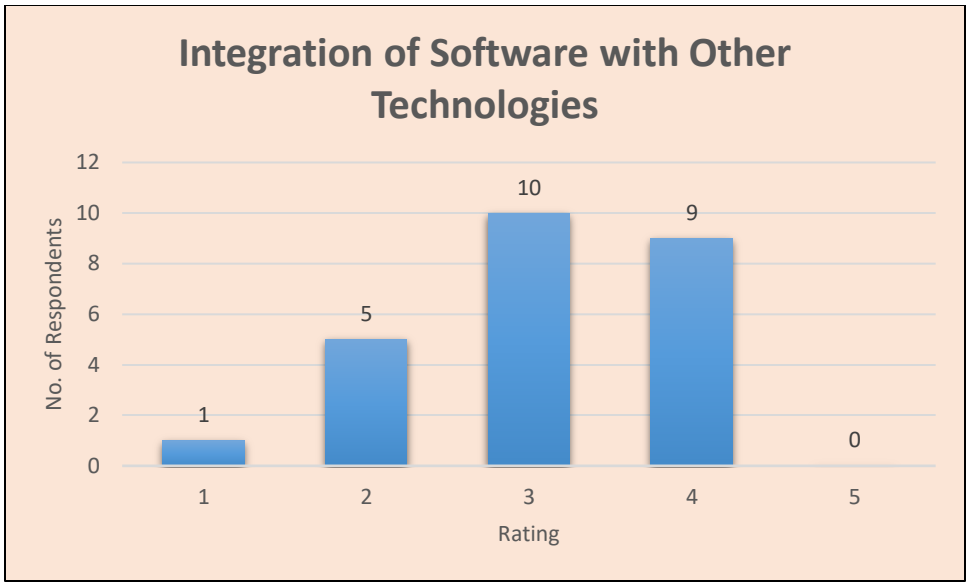


Fig.

No respondents rated the integration as outstanding 5.

Overall, the statistical analysis suggests that the integration of the software with other technologies and software used in the hospital is generally perceived as satisfactory, with a majority of respondents rating it as average to good. However, there is room for improvement, as a significant percentage of respondents rated the integration as only average 2 or good 3.

Q11.

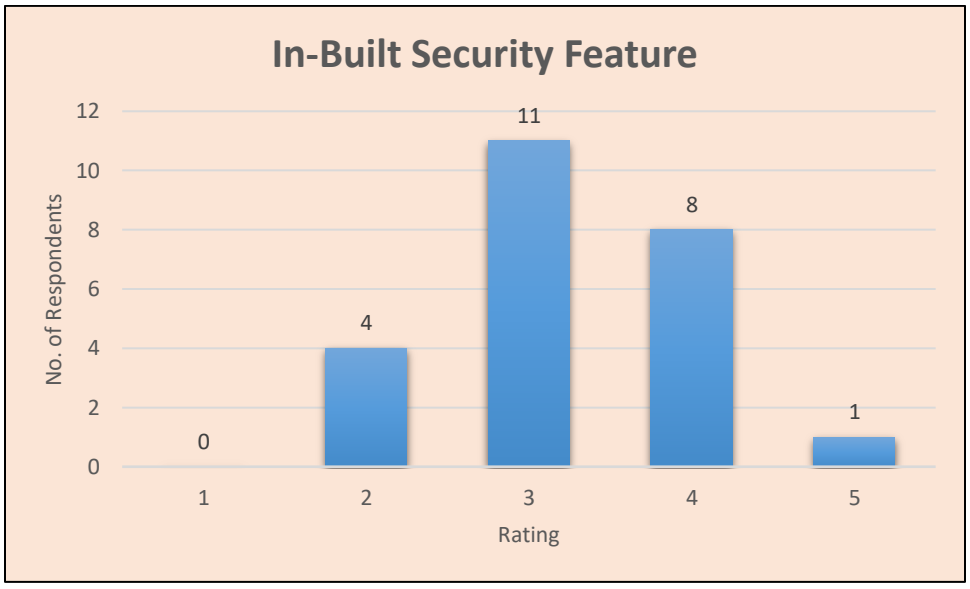


Fig.

The statistical analysis indicates that 45.8% of the in-built security features provided in the software were rated as "3" on a scale of 1 to 5. This suggests that the majority of the security features are considered average by users.

33.3% of the features were rated as "4", indicating a relatively high level of security, while 16.7% were rated as "2", indicating below-average security features.

Interestingly, only 4% of the features were rated as "5", suggesting that very few users believe that the software has exceptional security features. Finally, none of the features were rated as "1", which suggests that users generally do not consider the software to have very poor security features.

Q12.

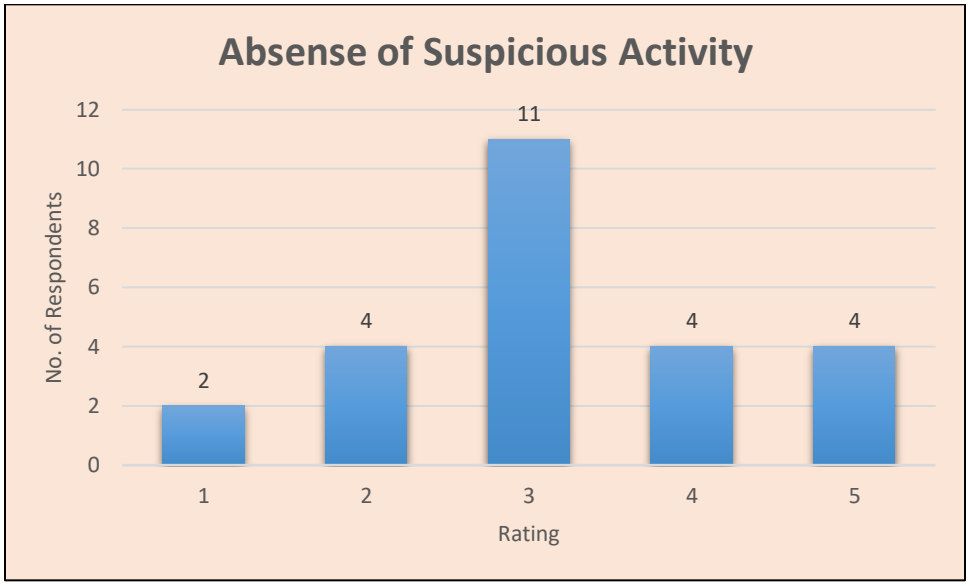


Fig.

Based on the statistics provided, it appears that 44% of users reported a neutral or average level of suspicious activity while using the software, as indicated by a rating of 3 on the scale of 1 to 5. The remaining ratings were distributed relatively evenly, with 16% of users reporting the lowest level of suspicious activity (a rating of 1), 16% reporting the highest level of suspicious activity (a rating of 5), and 16% reporting a moderate level of suspicious activity (a rating of 2 or 4). Overall, the results suggest that a significant proportion of users did not perceive any unusual or concerning activity while using the software, although there were some who reported experiencing suspicious activity to varying degrees.

Q13.

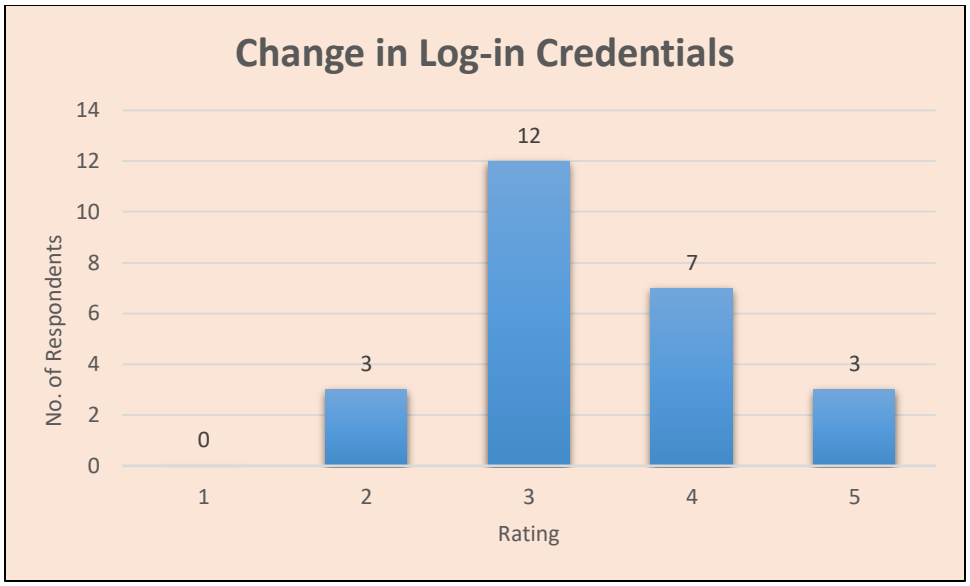


Fig.

Overall, it seems that a significant number of users are changing their login credentials on a regular basis, with the majority rating their frequency as "3". This may indicate a strong concern for security and a desire to protect sensitive information from unauthorized access. However, more data and analysis may be needed to fully understand the reasons behind users' choices and the implications for the software's security and usability.

Q14.

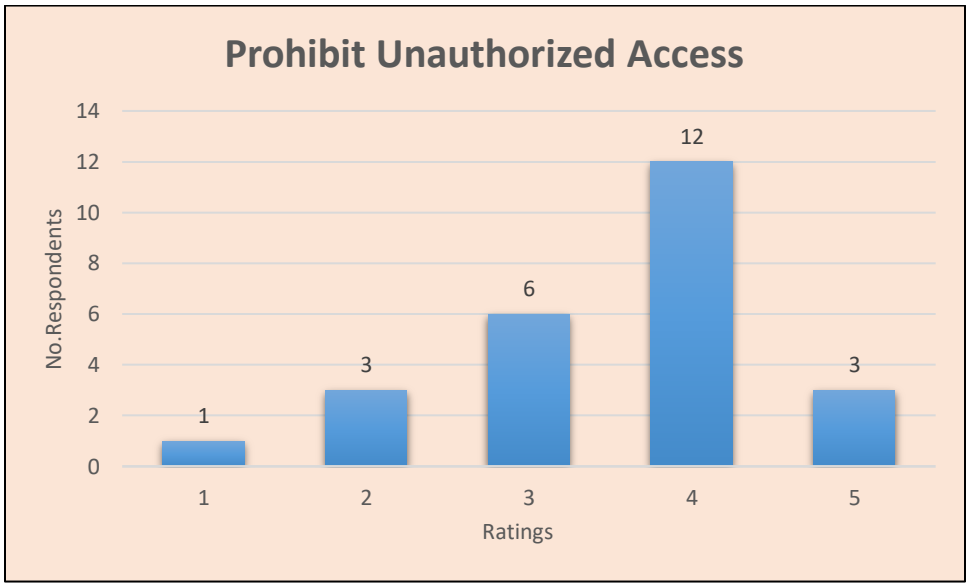


Fig.

Overall, it seems that the features provided to prohibit unauthorized access and use of the software were generally well-received, with the majority of respondents rating them as a 4. However, there may be some room for improvement, as a significant portion of respondents rated the features as a 2 or 3. Further analysis may be needed to determine specific areas for improvement.

Q15.

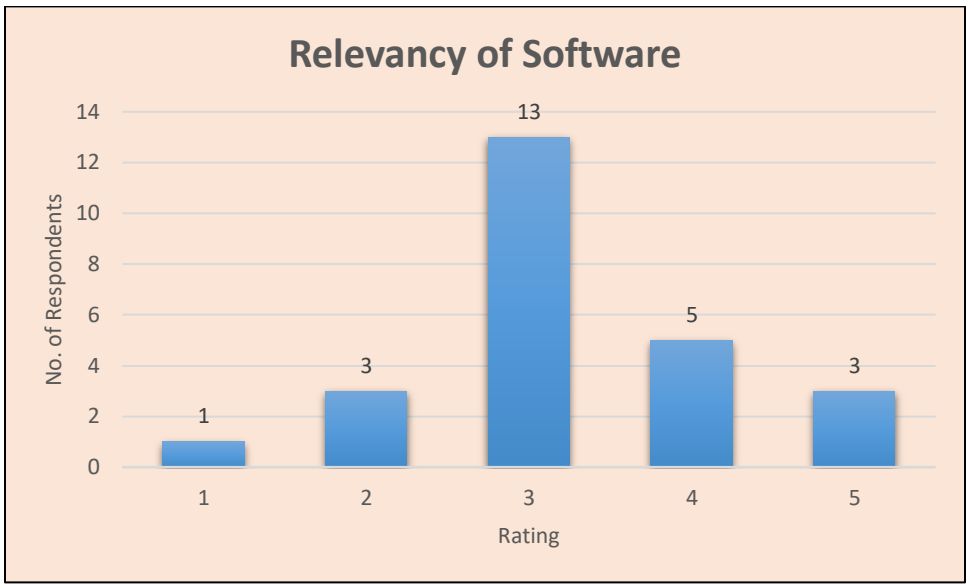


Fig.

Based on the statistical analysis, the software appears to be moderately relevant for carrying out daily duties. This is supported by the fact that over half of the respondents rated it a 3, while a relatively small percentage rated it a 1 or 5. Specifically, 4% of respondents rated it a 1, 12% rated it a 2, 52% rated it a 3, 20% rated it a 4, and 12% rated it a 5. Overall, the majority of respondents rated the software as "average" or "good" for daily duties, with a smaller percentage indicating it was either "poor" or "excellent".

Q16.

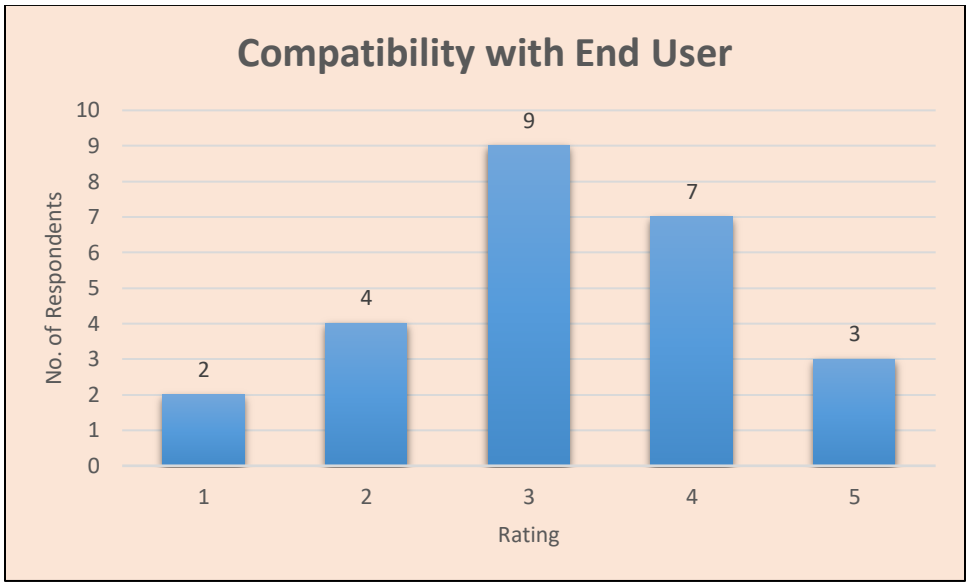


Fig.

Based on the statistical analysis, it appears that the majority of end users' expectations are not being fully met by the software. Only 12% of users rated the software as a 5, which suggests that the software is not meeting their expectations at the highest level. Additionally, 36% of users rated the software as a 3, which

is neutral and suggests that there is room for improvement. Furthermore, 28% of users rated the software as a 4, indicating that it is meeting their expectations to some extent. However, 1 and 2 received a combined 24% of the ratings, which is a significant proportion of users who feel that the software is not meeting their expectations at all. Therefore, the software development team may need to consider making improvements to increase the satisfaction of end users.

Q17.

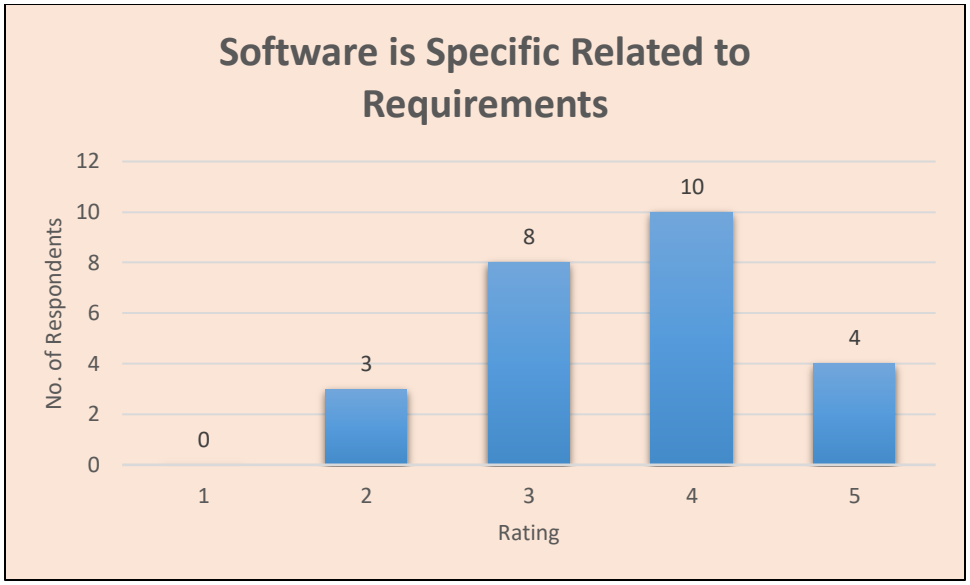


Fig.

Overall, the majority of respondents (72%) rated the software a 3 or higher, indicating that the software meets the requirements of the department to a satisfactory level. However, there is room for improvement as 12% of the respondents rated the software a 2 or lower.

Q18.

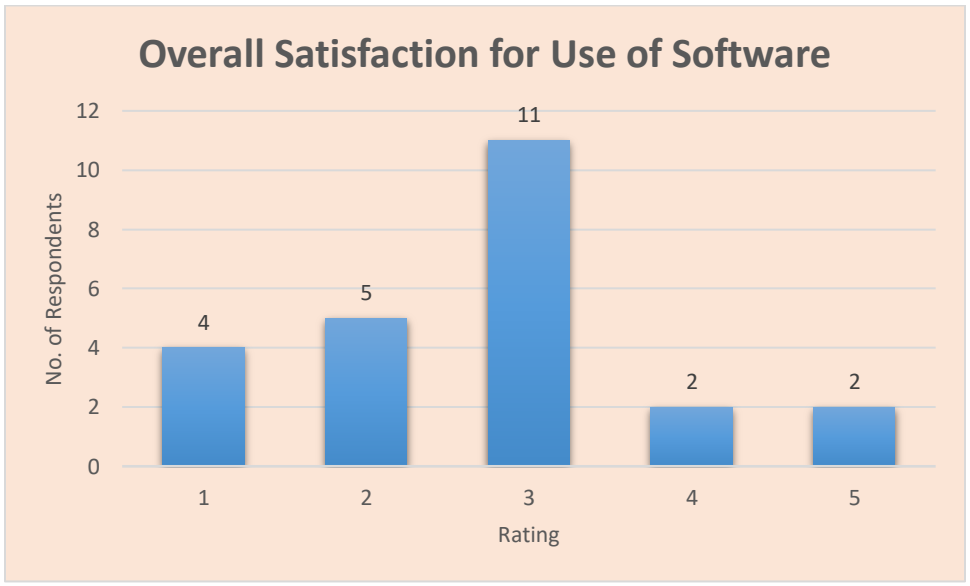


Fig.

Based on the analysis, it appears that the majority of users (45.8%) reported a moderate level of satisfaction (rated as 3 out of 5) with the software, while a significant proportion of users reported lower levels of satisfaction, with 16.7% giving a rating of 1 and 20.8% giving a rating of 2. A smaller proportion of users (8.3%) reported high levels of satisfaction, with a rating of 4 or 5. These results suggest that there may be some areas for improvement in the software in order to increase overall satisfaction and encourage future continuous use.

Q19.

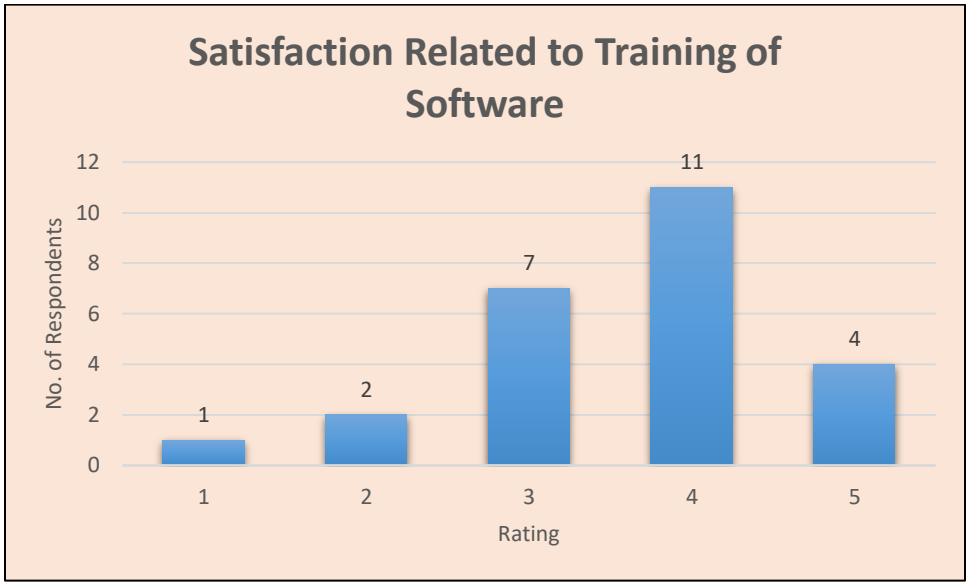


Fig.

Overall, it appears that the pre-implementation training of the software was moderately satisfactory, as most participants rated it as a 3 or 4. However, there is room for improvement as only a small percentage of participants rated it as a 5, which indicates that some participants were not completely satisfied with the training. The low percentage of participants who rated it as a 1 or 2 suggests that the training was generally effective, but there may have been some areas where it could have been improved.

Q20.

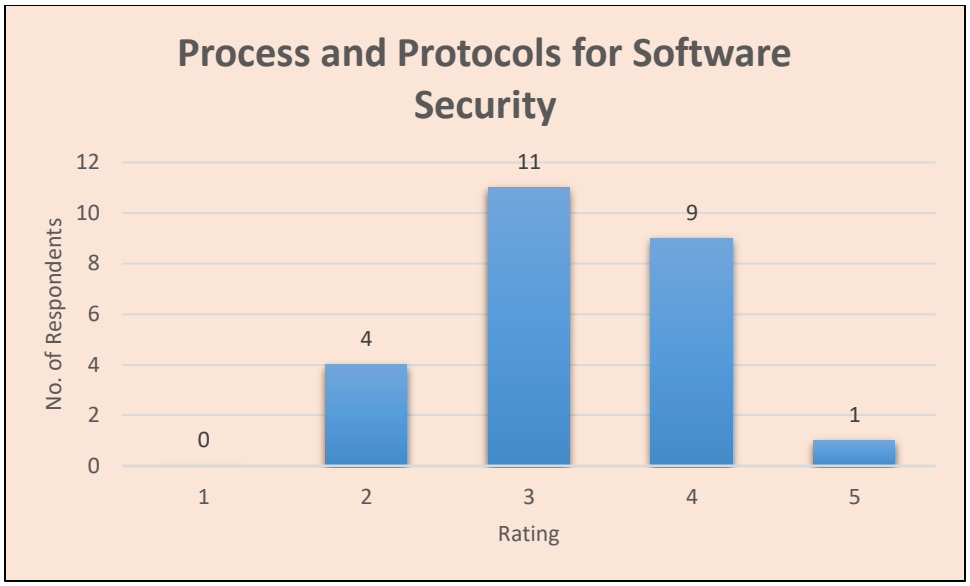


Fig.

Overall, the results suggest that while some level of processes and protocols for monitoring software security exist, there is room for improvement in terms of comprehensiveness and effectiveness.

Q21.

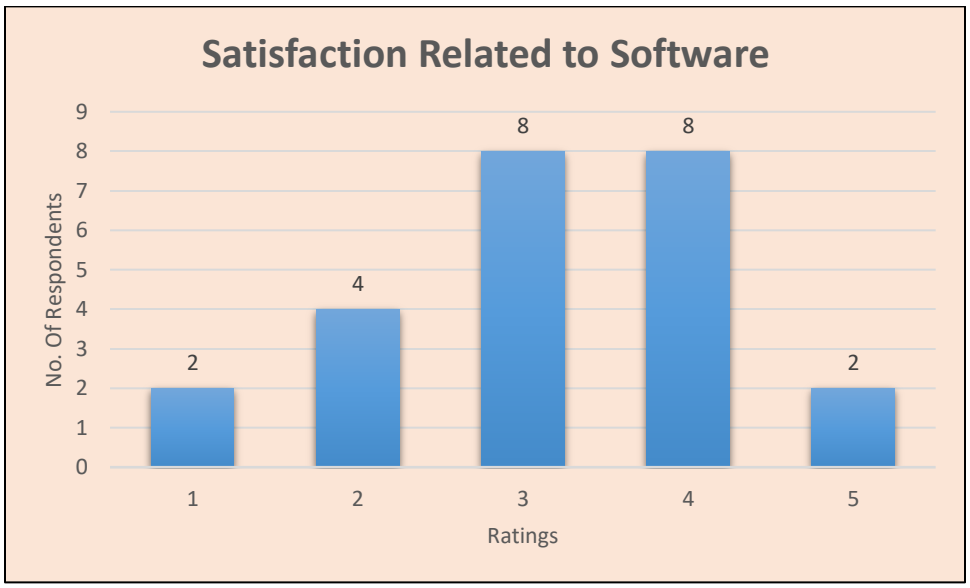


Fig.

The majority of customers (66.6%) rated their satisfaction with software maintenance by the support team as average to above average, with a rating of 3 or 4 on a scale of 1 to 5. However, there is a notable proportion of customers who rated their satisfaction as below average, with 8.3% giving a rating of 1 and 16.7% giving a rating of 2. Only 8.3% of customers rated their

satisfaction as excellent, with a rating of 5. Overall, there is room for improvement in the satisfaction levels of customers regarding software maintenance by the support team.

Q22.

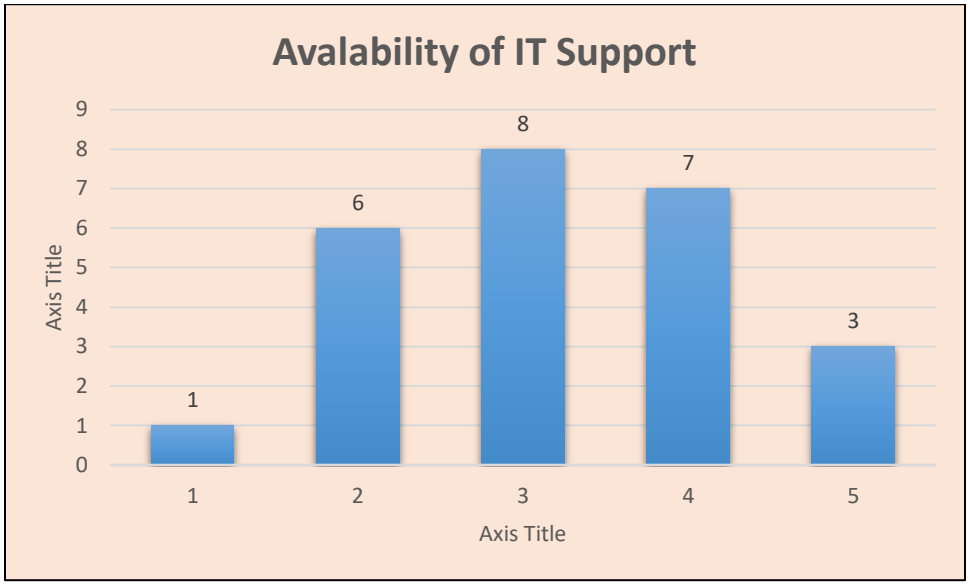


Fig.

Overall, it seems that there is room for improvement in the IT support for addressing queries related to software, as only a small percentage of respondents rated it as excellent 5, and a significant proportion rated it as below average 2. Further analysis and investigation may be needed to identify specific areas for improvement and to implement changes to improve the quality of IT support for software-related queries.

Q23.

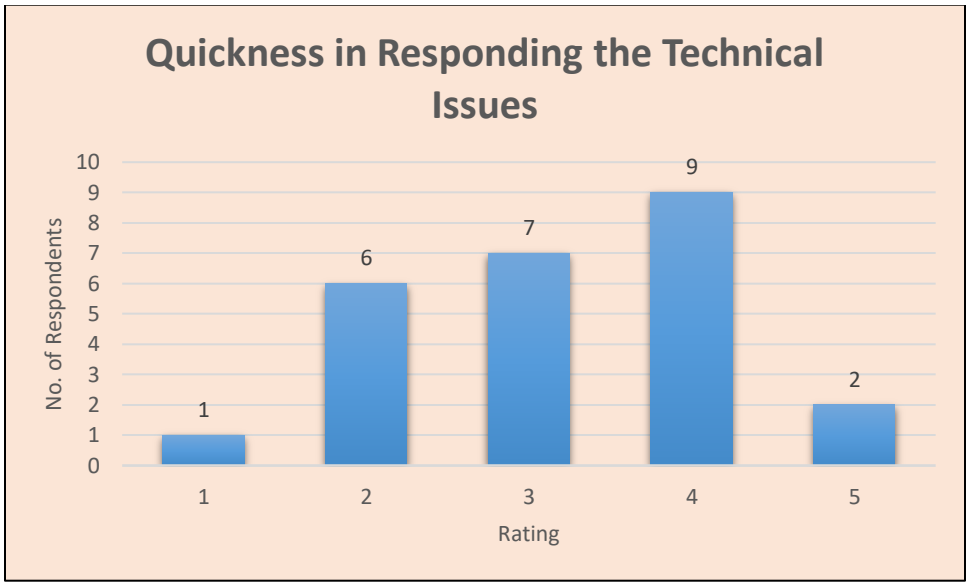


Fig.

Based on the given statistics analysis, the majority of the respondents (36%) 9 rated the quickness in responding to technical issues as a 4 on a scale of 1 to 5. About 28% of the respondents rated it as a 3, while 24% rated it as a 2. Only 4% of the respondents rated it as a 1, and 8% of the respondents rated it as a 5.

Overall, the results suggest that a significant portion of the respondents were satisfied with the quickness of response to technical issues, with a majority rating it at a 4. However, there is still room for improvement, as a significant proportion of respondents rated it at a 2 or 3.

Discussion:

The discussion focuses on the user satisfaction levels and areas for improvement in a particular system, likely related to a software or platform. The analysis of various aspects of the system provides insights into the strengths and weaknesses, highlighting the need for enhancements to enhance user experience and overall effectiveness.

Ease of Access:

The feedback received for the ease of access indicates a mixed response from users. While a significant proportion rated it as average, suggesting an acceptable level of usability, there is room for improvement. The below-average ratings indicate that certain aspects of the system may pose challenges for users in terms of navigation or overall user interface. By addressing these concerns, the system can become more user-friendly and intuitive, leading to a better overall user experience.

Usefulness of Shared Information:

The neutral perception of the usefulness of shared information highlights an opportunity for further improvement. While the majority rates it as average, indicating that the information meets their basic needs, it falls short of being considered highly valuable or essential. This suggests that additional efforts should be made to enhance the quality and relevance of the shared information, ensuring that it provides meaningful insights and addresses the users' requirements more effectively.

Timely Availability of Information:

The moderate rating for the timeliness of information suggests that the system performs adequately in delivering information in a timely manner. However, the presence of both untimely and highly timely ratings indicates inconsistencies in this aspect. To enhance user satisfaction, efforts should be focused on streamlining the delivery of information, minimizing delays, and ensuring that the timing of information aligns with users' expectations and needs.

Accuracy of Shared Information:

The ratings for the accuracy of shared information highlight a significant area of concern. With the majority rating it as average and a notable portion rating it below average, it is clear that improvements are needed to enhance the accuracy of the shared information. Addressing this issue is crucial, as inaccurate information can lead to misunderstandings, errors, and potential negative consequences. Implementing mechanisms for verifying and validating the information before sharing it can help increase accuracy and reliability, thereby improving user trust and satisfaction.

Timeliness of Shared Information:

Similar to the timeliness of information, the ratings for the timeliness of shared information show a mixed response. While the majority rated it as moderate, indicating an acceptable level of timeliness, the presence of both highly timely and untimely ratings suggests inconsistencies in this aspect as well. Efforts should be made to ensure that the timing of shared information aligns with users' expectations, minimizing any delays or untimeliness that might hinder their workflows or decision-making processes.

Response Time:

The majority of users rated the response time as average, suggesting that the system generally performs adequately in terms of responsiveness. However, the small percentage of users who experienced slow or fast response times indicates the need for improvement in this area. Optimizing response times and minimizing delays can significantly enhance the user experience, allowing for more efficient interactions with the system and reducing potential frustrations.

Reduction of Technical Issues:

The moderate level of improvement in reducing technical issues indicates progress but also highlights ongoing challenges. The significant portion of users rating it low suggests that technical issues still persist and may negatively impact user experience and productivity. Further enhancements are necessary to address these issues, such as thorough testing, bug fixing, and continuous monitoring of the system's performance. By striving for a more stable and reliable system, user satisfaction can be significantly improved.

Upgrade Frequency:

The generally positive ratings for the upgrade frequency indicate that users are satisfied with the regular updates and improvements made to the system. However, the small portion rating it below average suggests that there is room for improvement in this aspect as well. Ensuring that upgrades are meaningful, address user needs, and are communicated effectively can help maintain user satisfaction and drive continuous improvement.

System Performance:

The perception of system performance as moderately good indicates a balanced view among users, with neither exceptional praise nor significant dissatisfaction. However, the need for ongoing monitoring and improvements emphasizes the importance of continuously optimizing the system's performance. By identifying and addressing any performance bottlenecks or areas of inefficiency, the system can provide a more seamless and satisfactory experience to its users.

Integration with Other Technologies:

The generally satisfactory ratings for the integration of the system with other technologies and hospital systems highlight its effectiveness to a certain extent. However, the significant portion of users rating it as average or good suggests that further improvements are needed to enhance integration capabilities. Strengthening interoperability, streamlining data exchange processes, and addressing any compatibility issues can lead to better integration and collaboration across various technological components, ultimately improving the overall efficiency and effectiveness of the system.

Suggestions:

Based on the above Discussion, the following suggestions can be made:

- Define clear technical requirements: To avoid confusion and ambiguity, clear technical requirements should be defined for the HIS.
- Consider all user needs: The HIS should be designed keeping in mind the needs of all users including healthcare providers, administrators, and patients.
- Ensure interoperability: Interoperability of the HIS with other systems should be ensured to enable seamless data exchange.
- Incorporate security measures: Robust security measures should be incorporated in the HIS to protect patient data.
- Ensure data accuracy: Accurate data is essential for effective healthcare delivery. Therefore, the HIS should be designed in a way that ensures data accuracy.
- Ensure data privacy: Patient data is highly sensitive and its privacy should be ensured by incorporating appropriate measures in the HIS.
- Ensure data accessibility: The HIS should be designed to ensure that authorized users can access patient data easily and quickly.
- Ensure user-friendliness: The HIS should be user-friendly and easy to use to encourage healthcare providers to adopt it.
- Provide training and support: Training and support should be provided to healthcare providers to ensure they can use the HIS effectively.
- Regular maintenance and updates: Regular maintenance and updates should be carried out to ensure that the HIS remains up-to-date and functions smoothly.
- Cost-effectiveness: The HIS should be cost-effective to encourage healthcare providers to adopt it.

    - Consider scalability: The HIS should be designed to accommodate future growth and expansion.
    - Incorporate analytics: Analytics tools should be incorporated in the HIS to enable effective analysis of patient data.
    - Enable remote access: The HIS should be designed to enable remote access to patient data for healthcare providers who are not on-site.
    - Ensure compliance with regulations: The HIS should be designed to ensure compliance with all relevant regulations and standards.
    - Encourage patient engagement: The HIS should be designed to encourage patient engagement and enable patients to access their own health data.
    - Ensure system reliability: The HIS should be reliable and able to function consistently to enable effective healthcare delivery.
    - Provide data backup and recovery: Robust data backup and recovery mechanisms should be in place to prevent data loss in the event of a system failure.
    - Ensure system performance: The HIS should be designed to ensure optimal system performance.
    - Consider cultural factors: Cultural factors should be taken into account when designing the HIS to ensure its acceptability among different communities.
    - Enable data sharing: The HIS should be designed to enable data sharing among different healthcare providers and institutions.
    - Ensure data standardization: Standardization of data is essential for effective data sharing and analysis. The HIS should be designed to ensure data standardization.
    - Ensure ethical considerations: Ethical considerations should be taken into account when designing the HIS to ensure that patient rights are protected and respected.
- The importance of designing a robust HIS that is user-friendly, secure, cost-effective, and compliant with regulations. To ensure the success of the HIS, all user needs must be considered, and appropriate training and support should be provided. Regular maintenance and updates should be carried out to ensure that the HIS remains up-to-date and functions smoothly. Finally, ethical considerations should be taken into account to ensure that patient rights are protected and respected.

Key Risk and Challenges:

It is likely that in order to achieve the required quality metrics, there may be need for

RGCIRC's investment in time, effort, employee training, finances and managing the change.

The organizational costs and risks of poorly managing change include (but not limited to):

- Employee Resistance
- Key Resources not made available
- Project fails to deliver results
- Decline in morale
- Stress, confusion and fatigue
- Efficiencies not gained
- Regulations not met

- Loss of invested revenue & efforts

Conclusion:

In conclusion, the analysis of the technical requirements for Healthcare Information Systems (HIS) has shed light on critical gaps that require immediate attention to enhance the efficiency and effectiveness of healthcare delivery. The identified gaps primarily revolve around interoperability, data management, security, and usability, which are vital aspects of any robust HIS system.

Interoperability is a key area of concern as it impacts the seamless sharing of information and communication between different healthcare providers and systems. The lack of standardized protocols and data formats can hinder the exchange of crucial patient data, potentially compromising the quality of care and continuity of treatment. Efforts should be made to establish common standards and facilitate interoperability to ensure seamless communication and collaboration across various healthcare entities.

Data management plays a pivotal role in ensuring accurate, reliable, and accessible information within HIS. Inadequate data governance, inconsistent data entry practices, and fragmented data storage can lead to data discrepancies, duplication, and errors. Implementing robust data management strategies, including standardized data capture methods, data quality checks, and centralized data repositories, can significantly enhance the accuracy and integrity of patient data, facilitating better clinical decision-making and improved patient outcomes.

Security is a paramount concern in healthcare, given the sensitivity and confidentiality of patient information. The gaps identified in this area indicate potential vulnerabilities in data privacy and protection. Strengthening security measures, including robust authentication mechanisms, data encryption, regular security audits, and staff training on data protection protocols, is crucial to safeguard patient data and mitigate the risk of unauthorized access or breaches.

Usability encompasses the user-friendliness and acceptability of HIS systems, directly impacting their adoption and effectiveness in clinical settings. Difficulties in navigating complex interfaces, cumbersome workflows, and limited user customization options can hamper healthcare professionals' productivity and satisfaction. Enhancing usability through intuitive designs, user-centered development processes, and continuous user feedback can foster better acceptance and utilization of HIS systems, improving overall healthcare delivery.

Addressing these identified gaps is paramount for healthcare providers and policymakers to ensure the delivery of high-quality care, accurate data management, and robust security measures. Investments should be made in HIS systems that are specifically designed to meet these critical requirements, considering interoperability standards, comprehensive data management frameworks, robust security protocols, and user-centric design principles.

By prioritizing these efforts, healthcare organizations can optimize the use of HIS systems, leading to improved patient care, streamlined workflows, and enhanced data security. Collaboration between healthcare providers, policymakers, and technology experts is vital to drive these

necessary changes and create a healthcare ecosystem that leverages the full potential of HIS systems for better patient outcomes and efficient healthcare delivery.

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Annexures:

Software Evaluation Form

We would appreciate if you can take a couple of minutes to evaluate how our software PARAS is working.

NAME:

JOB ROLE:

DEPARTMENT:

Note: the responses to these questions can be rated on a scale of 1 to 5 with 1 being the least satisfactory 5 being the most satisfactory. Highlight your responses with○

Sharing of information & communication

Q1. Ease of access of health information through the software

1 2 3 4 5

Q2. Usefulness of the health information shared to doctors & nurses through the software

1 2 3 4 5

Q3. Availability of the information in a timely manner

1 2 3 4 5

Q4. Accuracy of the information being shared

1 2 3 4 5

Q5. Timeliness (real time sharing) of the information being shared

1 2 3 4 5

Performance

Q6. Response time of the software to queries

1 2 3 4 5

Q7. Reduction in the number of technical issues related to working of the software

1 2 3 4 5

Q8. Upgrade frequency of the software

1 2 3 4 5

Q9. Overall system performance of the software

1 2 3 4 5

Q10. Integration of the software with other technologies and software used in the hospital

1 2 3 4 5

Security

Q11. In-built security features provided in the software

1 2 3 4 5

Q12. Absence of suspicious activity while using the software

1 2 3 4 5

Q13. Frequency of change of login credentials to use the software

1 2 3 4 5

Q14.Features provided to prohibit unauthorized access and use of software

1 2 3 4 5

User Acceptability

Q15. Relevancy of the software for carrying out daily duties

1 2 3 4 5

Q16. Compatibility of the software with the end user (doctors, nurses etc) expectations

1 2 3 4 5

Q17. Software is specific related to the requirements of the department

1 2 3 4 5

Q18. Overall satisfaction related to future continuous use of software

1 2 3 4 5

Technical Support

Q19. Satisfaction related to the pre- implementation training of the software

1 2 3 4 5

Q20. Existence of process and protocols for monitoring the software security

1 2 3 4 5

Q21. Satisfaction related to software maintenance by the support team

1 2 3 4 5

Q22. Availability of IT support for addressing queries related to software working

1 2 3 4 5

Q23. Quickness in responding to the technical issues

1 2 3 4 5

Q24. Is there any specific feature, requirement, or improvement you would like to suggest for the software

Thank you for your participation. Your responses will be valuable in helping us to improve the software and identify the areas that require improvement

Dissertation

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