Dissertation Training

At

Ernst and Young (EY) Delhi

A Descriptive Study on Requirement Gathering for the Digital Transformation of Outpatient and Inpatient Services in a Tertiary Care Hospital

By

Name: Dr Sonal Saxena

Enrolment Number: PG/21/110

Under the Guidance for

Dr Anandhi Ramachandran

PGDM (Hospital and Health Management)

2021-2023

International Institute of Health Management and Research

Internship Completion Certificate

This certificate is awarded to

Name Dr Sonal Saxena

in recognition of having successfully completed his/her
Internship in EY and has successfully completed his/her Project on

A Descriptive Study on Requirement Gathering for the Digital Transformation of Outpatient and Inpatient Services in a Tertiary Care Hospital

Date 1st February 2023 to 1st May 2023

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning.
We wish her all the best for future endeavours.

Ritviz Agrawal

Organization Manager

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Sonal Saxena,** a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. She is submitting this dissertation titled "**A Descriptive Study on Requirement Gathering for the Digital Transformation of Outpatient and Inpatient Services in a Tertiary Care Hospital**" at "**EY**" in partial fulfilment 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.

Institute Mentor Name	Organization Mentor Name- **Ritviz Agrawal**
Designation	Designation – **Senior Manager**
Organization	Organization - **EY**

FEEDBACK FORM

Name of the Student: Dr Sonal Saxena

Name of the Organization in Which Dissertation Has Been Completed: EY

Area of Dissertation: Health IT (AIIMS Project)

Attendance: 100%

Objectives achieved: Primary and Secondary Data Collection, Requirement Gathering

Deliverables: AS IS Study, To-Be Study, FRS & SRS

Strengths: Sincere, Hardworking, Willing to learn

Suggestions for Improvement:

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):
Practical Learnings along with theoretical for Students

Ritviz Agrawal
Organization Mentor (Dissertation)

Contents

1. Introduction

Digital transformation is the process of using digital technologies to create new — or modify existing — business processes, culture, and customer experiences to meet changing business and market requirements. (1)
Digital transformation will help hospitals make better logistical decisions and bring a faster response rate to critical functional activities. These will eventually enhance the quality and efficiency of care as well as the patient's overall experience within hospitals. (2)
Research suggests that digital health solutions could support patients in promoting ideal health behavior, improve their medication compliance and enhance their interaction with healthcare professionals. (3) This could also help in reducing the patient's length of stay in the hospital.
Currently, the tertiary hospital is not/partially digitalized, with manual academic, research, clinical and management workflows, patients have long waiting hours and the clinicians, nurses, faculty and staff also face a huge manual workload. The tertiary care hospital is undergoing the process of digital transformation to digitalize the manual processes, reduce the waiting time, to decrease the manual workload of the clinicians, nurses, staff and improve the hospital's workflows.

1.1. Rationale

- **Rising Need of Digital Transformation**: The OPD and IPD departments require to comprehend each of their specific needs in order to properly use digital technology because they are essential parts of a hospital's operations.
- **Process complexity and specificity of OPD and IPD:** In tertiary care institutions, the OPD and IPD departments have distinctive operational workflows, patient management systems, and challenging interdepartmental interactions.
- **Customized solutions need to be provided:** It is vital to adapt digital transformation approaches to accommodate the distinctive qualities of the OPD and IPD departments of a particular healthcare organization.
- **Mitigating Implementation Challenges:** It is essential to monitor and aid in the implementation of the Integrated HIS for the hospital and to provide adequate training to the staff.

1.2. Objectives

- To assess the need for digitalization in the OPD and IPD of a Tertiary Care Hospital.
- To collect, process and track the stakeholder needs and requirements.

2. Methodology

2.1. Research Questions

- What are the needs of the organization for digitalization of its workflow?
- What are the steps of digital transformation process that the tertiary care hospital is undergoing?
- What are the functional and system requirements for digitalization of OPD and IPD of a tertiary care hospital?

2.2. Research Design and Procedures

- **Research Design**: Descriptive Study
- **Research Data**: Primary Data
- **Study Population**: Doctors, Patients, Nurses
- **Sample Size & Selection**:
  - Convenience Sampling
  - Sample Size: 305 (formula: $n = N / (1 + n(e^2))$ where, e=confidence level (95%))
- **Inclusion Criteria:**
  - Must be working for AIIMS.
- **Exclusion Criteria:**
  - Healthcare workers who did not provide consent for the survey.
- **Data Collection Method:** Survey (google form tool attached in annexure) and Interviews.
- **Data Collection tool**: Semi structured questionnaire
- **Ethical Consideration:** The study will be conducted as a part of the digital transformation process of the hospital. The tools & ethical clearance will be provided by the organization. All the details provided by the stakeholders will be kept confidential and used for the purpose of the study.

3. Results

3.1. Demographics

Stakeholder	No. of Responses
Patient	145
Doctor	74
Nurse	86

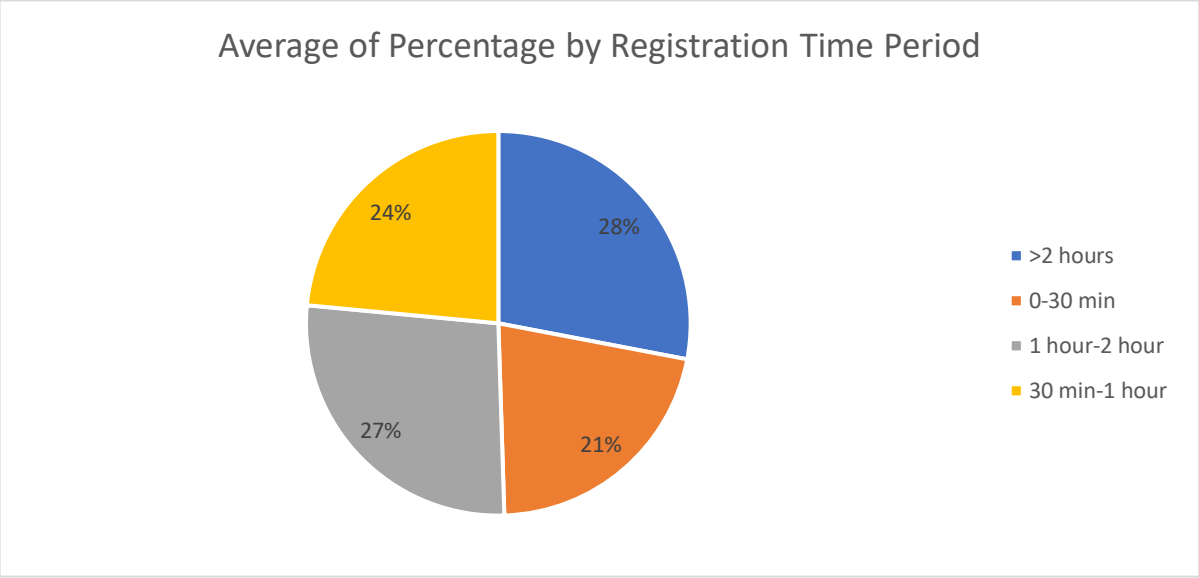
3.1.1. Patient

New patient vs Follow up patient

Patient	No. of Responses
New Patient	70
Follow Up Patient	75

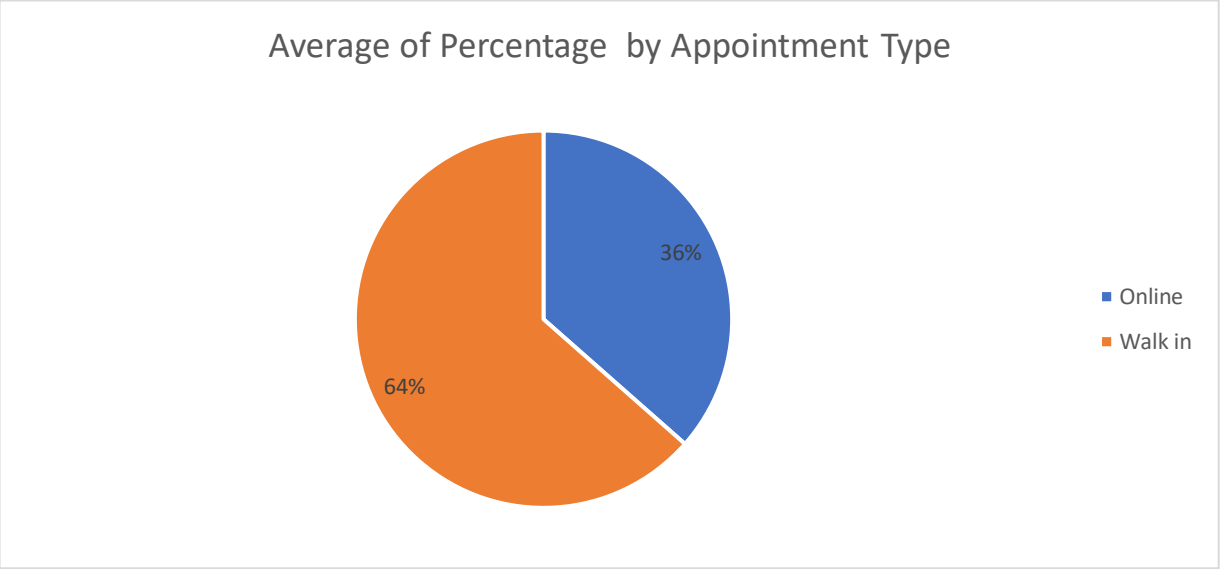
Time taken for registration

Type Of Patient	Registration Time Period	No. of Responses
New Patient	0 - 30 min	13
	30 min - 1 hour	16
	1 hour - 2 hour	19
	>2 hours	22
Follow Up Patient	0 - 30 min	18
	30 min - 1 hour	18
	1 hour - 2 hour	20
	>2 hours	19



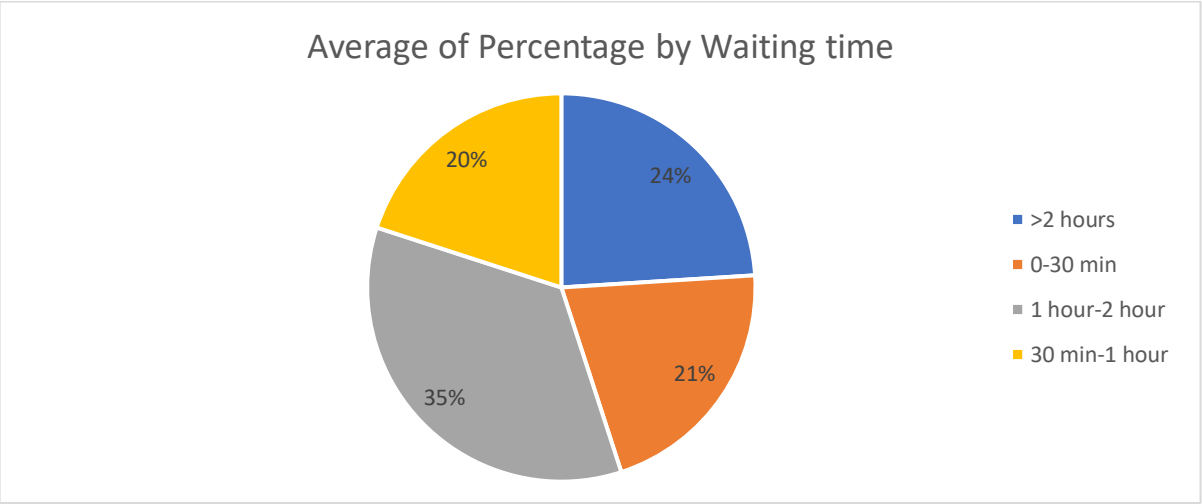
Walk in vs Online Appointment

Type Of Patient	Appointment Type	No. of Responses
New Patient	Walk in	41
	Online	29
Follow Up Patient	Walk in	51
	Online	24



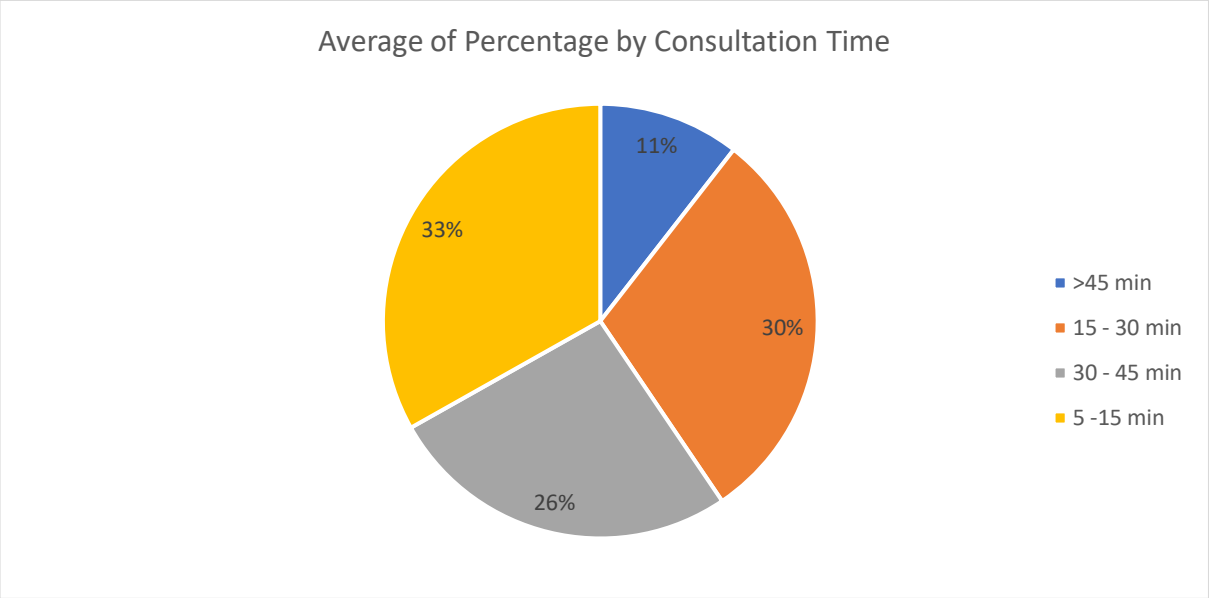
Time taken to meet the doctor

Type Of Patient	Waiting time	No. of Responses
New Patient	0-30 min	12
	30 min-1 hour	14
	1 hour-2 hour	25
	>2 hours	19
Follow Up Patient	0-30 min	19
	30 min-1 hour	15
	1 hour-2 hour	25
	>2 hours	16



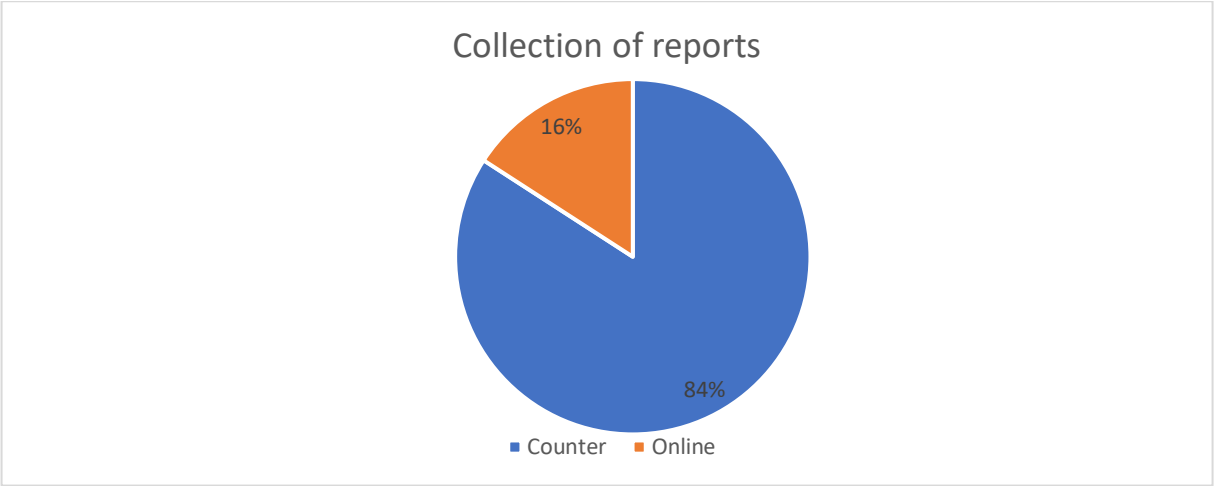
How much time does a doctor spend with you?

Type Of Patient	Consultation Time	No. of Responses
New Patient	5 -15 min	18
	15 - 30 min	24
	30 - 45 min	20
	>45 min	8
Follow Up Patient	5 -15 min	28
	15 - 30 min	25
	30 - 45 min	16
	>45 min	7



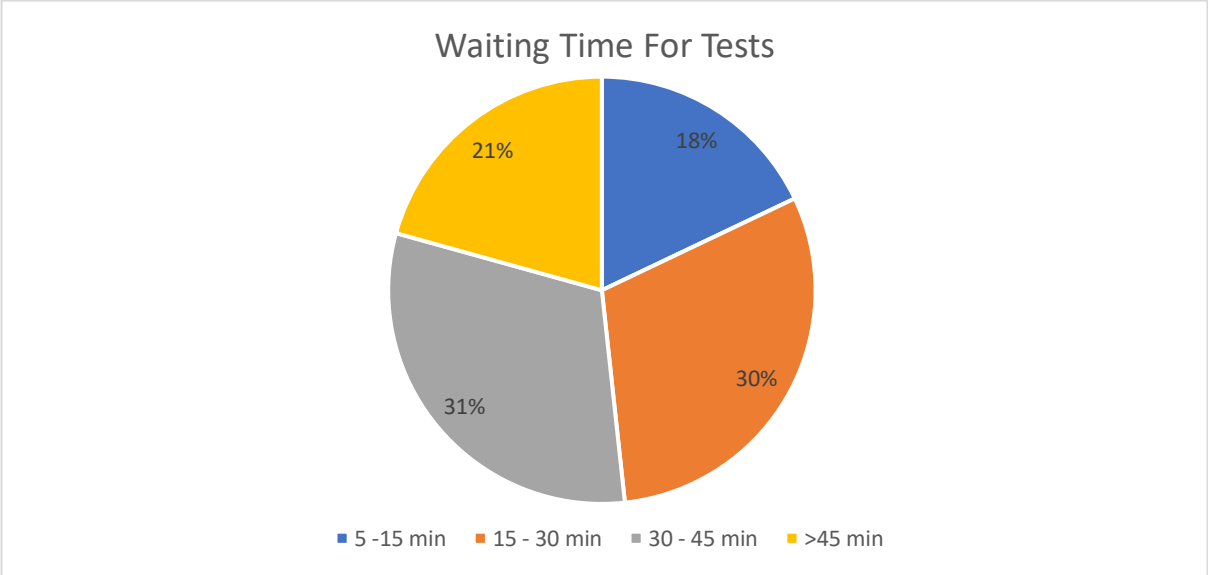
Collection of Lab reports – online vs counter

Patient	No. of Responses
Counter	122
Online	23



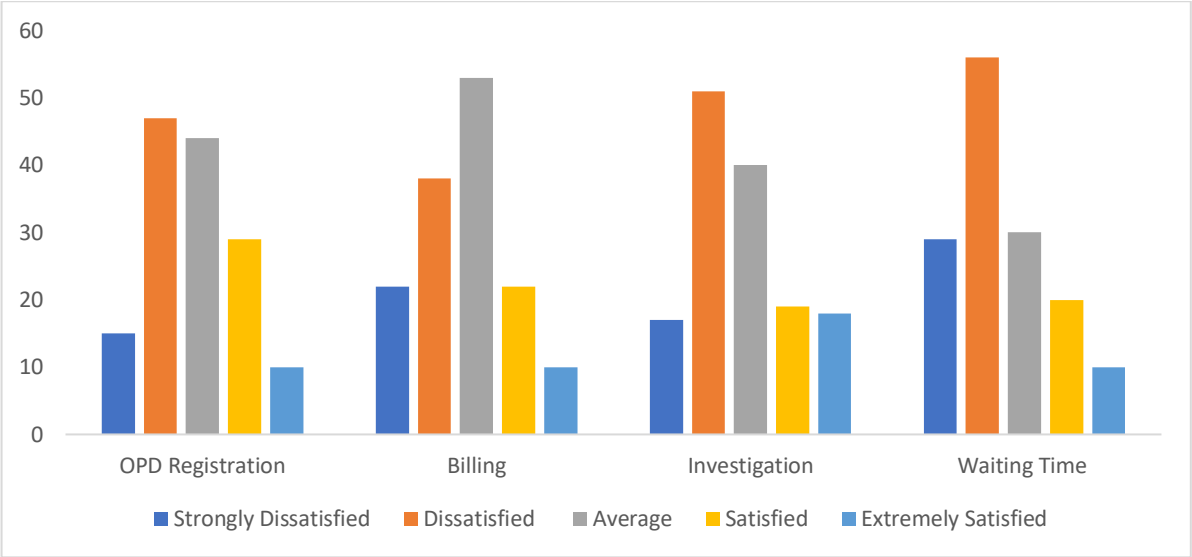
Waiting time for Tests

Wating Time for Tests	No. of Responses
5 -15 min	26
15 - 30 min	44
30 - 45 min	45
>45 min	30



Satisfaction level of patients

	OPD Registration	Billing	Investigation	Waiting Time
Strongly Dissatisfied	15	22	17	29
Dissatisfied	47	38	51	56
Average	44	53	40	30
Satisfied	29	22	19	20
Extremely Satisfied	10	10	18	10


60
50
40
30
20
10
0
OPD Registration
Billing
Investigation
Waiting Time
Strongly Dissatisfied
Dissatisfied
Average
Satisfied
Extremely Satisfied

Feedback

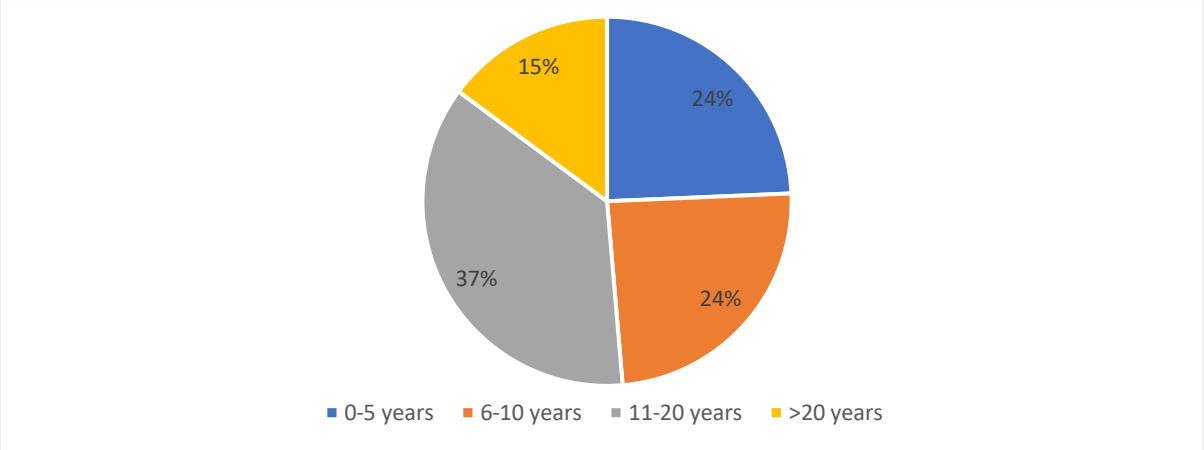
85 patients had given feedback, for which those feedback could be classified into 4 categories: People, Process, Technology, and Infrastructure.

S.no	Feedback Received	No. of Responses
People		
1	The hospital staff doesn’t behave properly	5
2	The treatment details, diagnosis and payment details aren't communicated properly with the patient	15
3	Inadequate training and behaviour of senior residents	4
4	Documents get misplaced by the doctors and staff	4
5	Improper time management by the staff. Tests, check-ups which could be completed in 1 day, takes more days to complete.	7
6	Shortage of doctors	5
Process		
1	Poor Queue Management	15
2	Slow registration process	6
3	There are issues in Appointment Management	6
4	Longer waiting period for surgery	19
5	Waiting time for OPD is high	10
6	Doctor spends very less time with the patients	15
7	Poor Service	5
8	Expensive Medications	6
9	Services should be fast paced	3
10	Long appointment schedule for tests	10
Technology		
1	All the tests’ results should be made available online	18
2	Provide alerts/notifications for tests results	15
3	Poor Network Connection	10
4	No Mode of Online Payment	5
5	Online portal for booking appointment has issues	11
6	Poor IT Services	5
Infrastructure		
1	Improper physical infrastructure in OPD Waiting areas and Emergency waiting areas	13
2	Counters are far away	20
3	There are no Signage present to guide the patient for directions in the hospital	25

3.1.2. Doctor

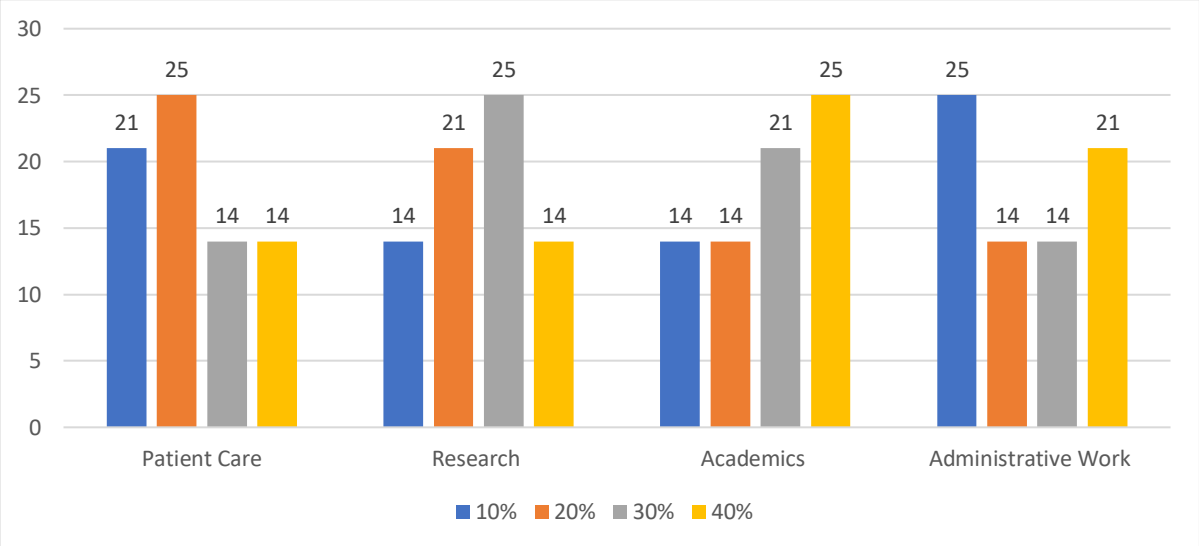
Experience at AIIMS

Experience	No. of Responses
0-5 years	18
6-10 years	18
11-20 years	27
>20 years	11



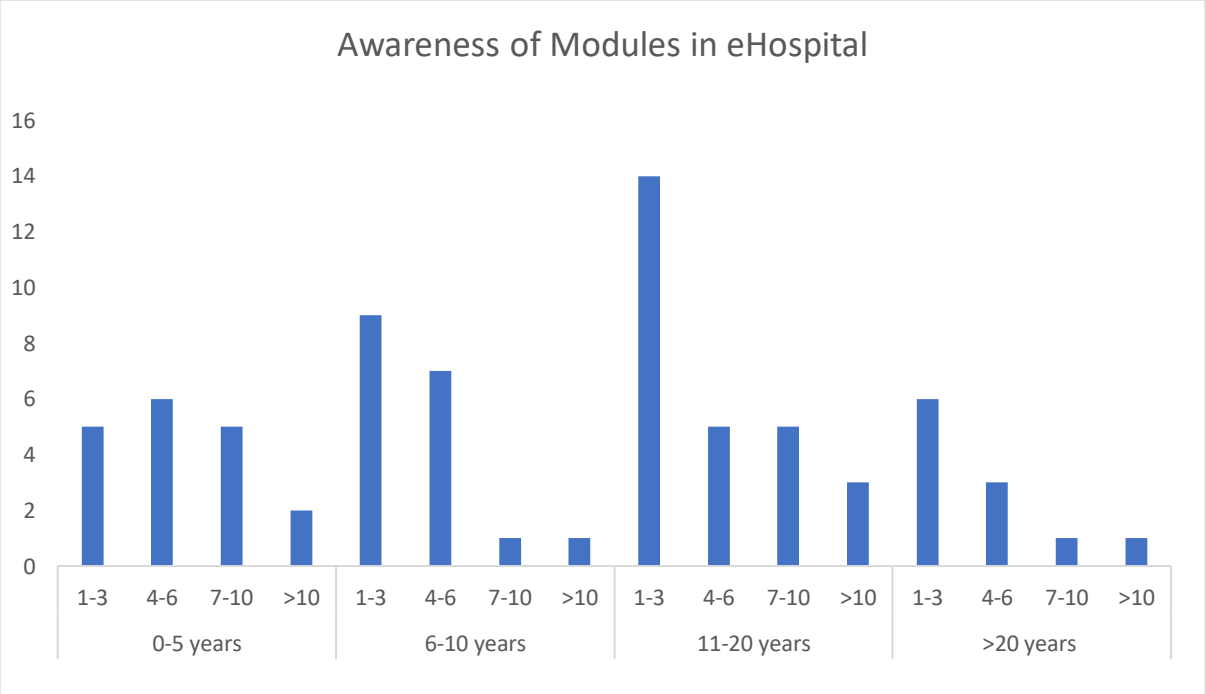
Time spent on Various Activities:

Activities	No. of Responses			
	10%	20%	30%	40%
Patient Care	21	25	14	14
Research	14	21	25	14
Academics	14	14	21	25
Administrative Work	25	14	14	21



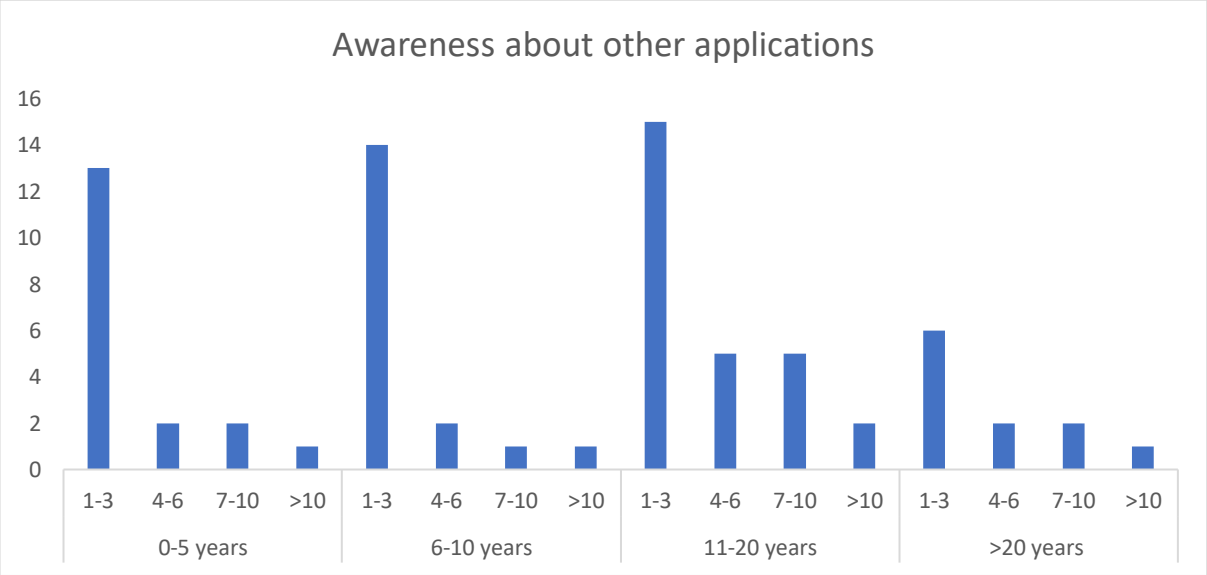
Awareness of Module sin eHospital

Experience	No. of Modules	No. of Responses	Percentage
0-5 years	1-3	5	7%
	4-6	6	8%
	7-10	5	7%
	>10	2	3%
6-10 years	1-3	9	12%
	4-6	7	9%
	7-10	1	1%
	>10	1	1%
11-20 years	1-3	14	19%
	4-6	5	7%
	7-10	5	7%
	>10	3	4%
>20 years	1-3	6	8%
	4-6	3	4%
	7-10	1	1%
	>10	1	1%



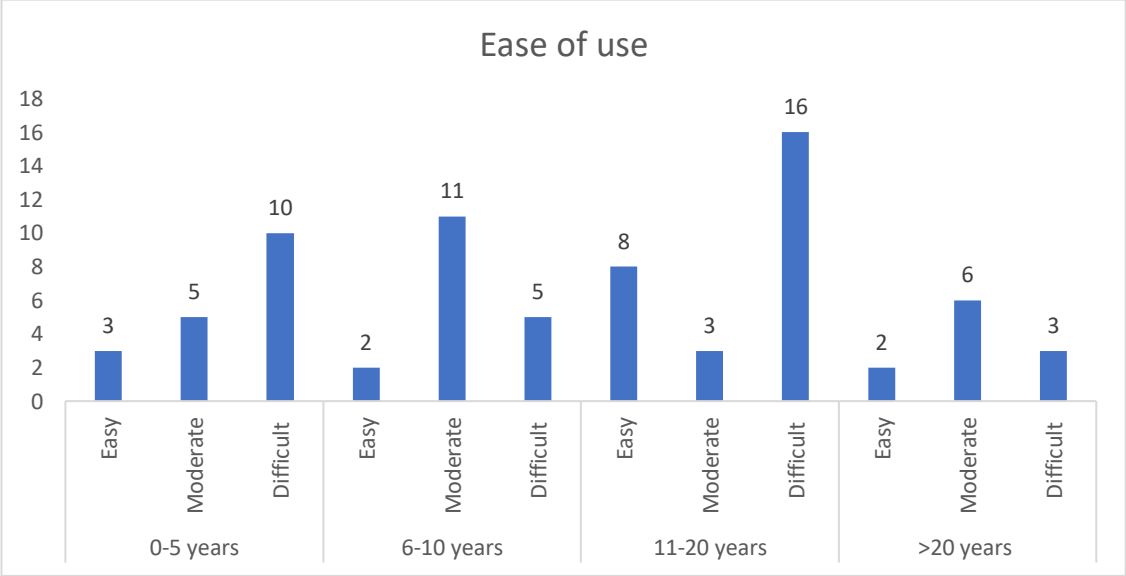
Knowledge about other applications

Experience	No. of Application	No. of Responses	Percentage
0-5 years	1-3	13	18%
	4-6	2	3%
	7-10	2	3%
	>10	1	1%
6-10 years	1-3	14	19%
	4-6	2	3%
	7-10	1	1%
	>10	1	1%
11-20 years	1-3	15	20%
	4-6	5	7%
	7-10	5	7%
	>10	2	3%
>20 years	1-3	6	8%
	4-6	2	3%
	7-10	2	3%
	>10	1	1%



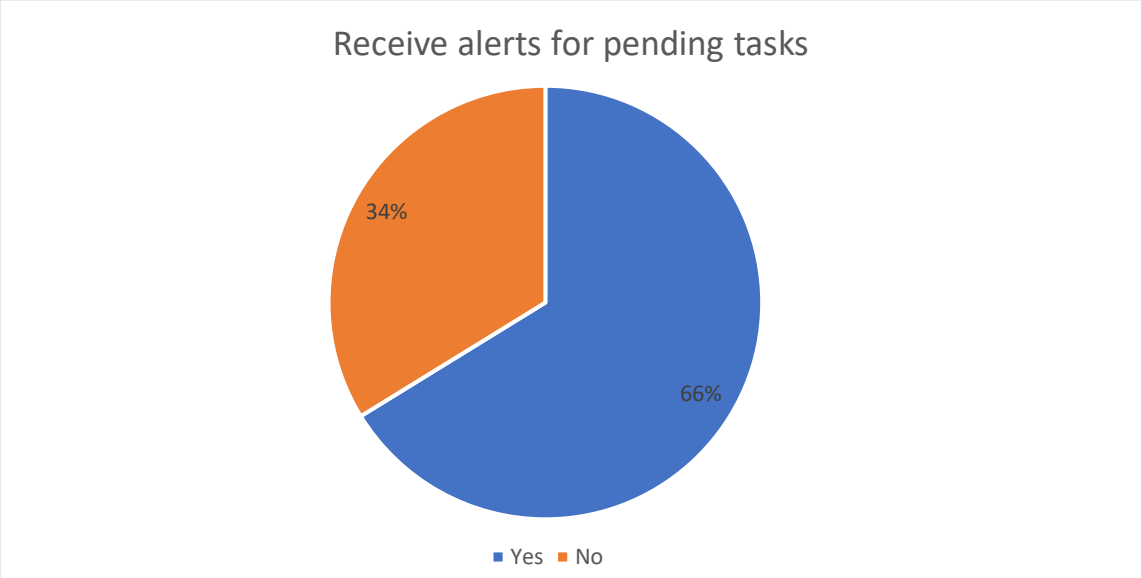
Is it easy to use eHospital?

Experience	Ease of Use	No. of Responses
0-5 years	Easy	3
	Moderate	5
	Difficult	10
6-10 years	Easy	2
	Moderate	11
	Difficult	5
11-20 years	Easy	8
	Moderate	3
	Difficult	16
>20 years	Easy	2
	Moderate	6
	Difficult	3



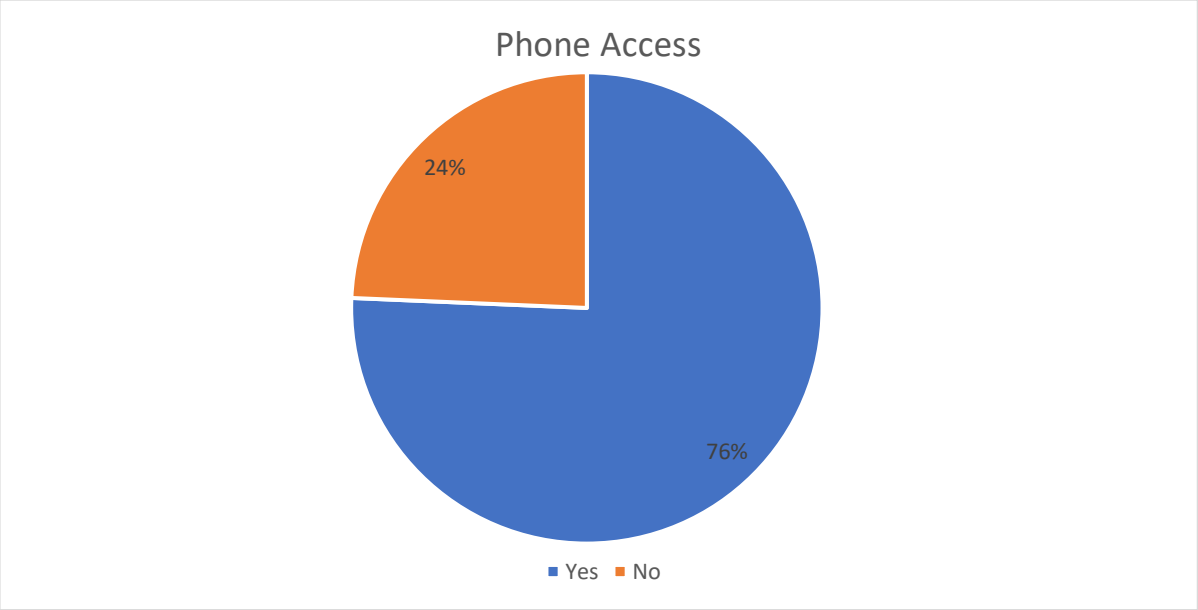
Receive alerts for pending tasks

Receive Alerts	No. of Responses
Yes	49
No	25



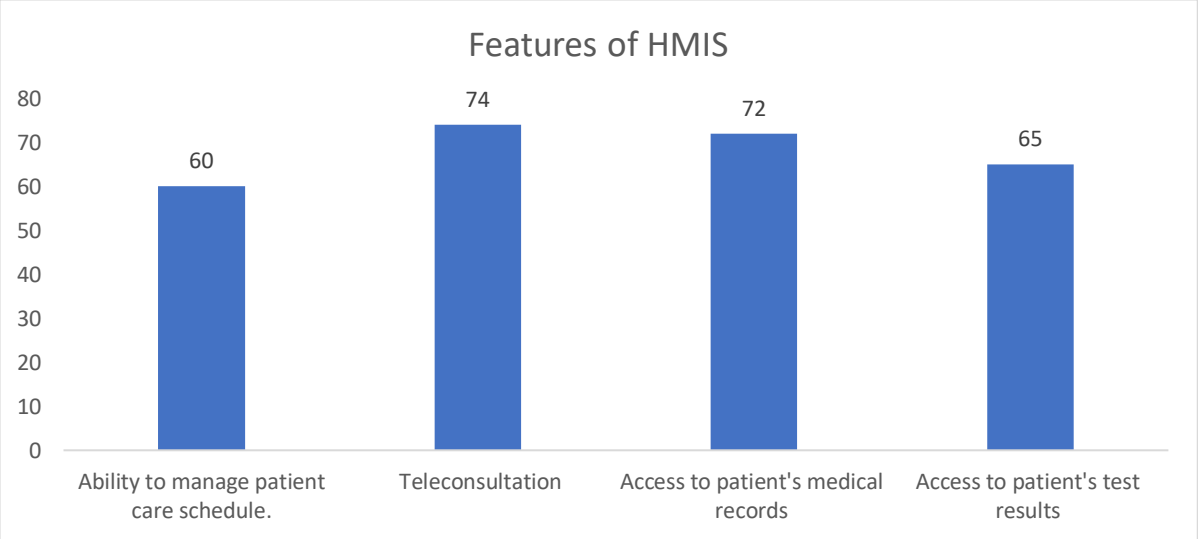
Phone access to tasks related to patients, administration, academic and research

Phone access	No. of Responses
Yes	56
No	18



What features would u need in the HMIS?

What would you like in new system?	No. of Responses
Ability to manage patient care schedule.	60
Teleconsultation	74
Access to patient's medical records	72
Access to patient's test results	65



Feedback

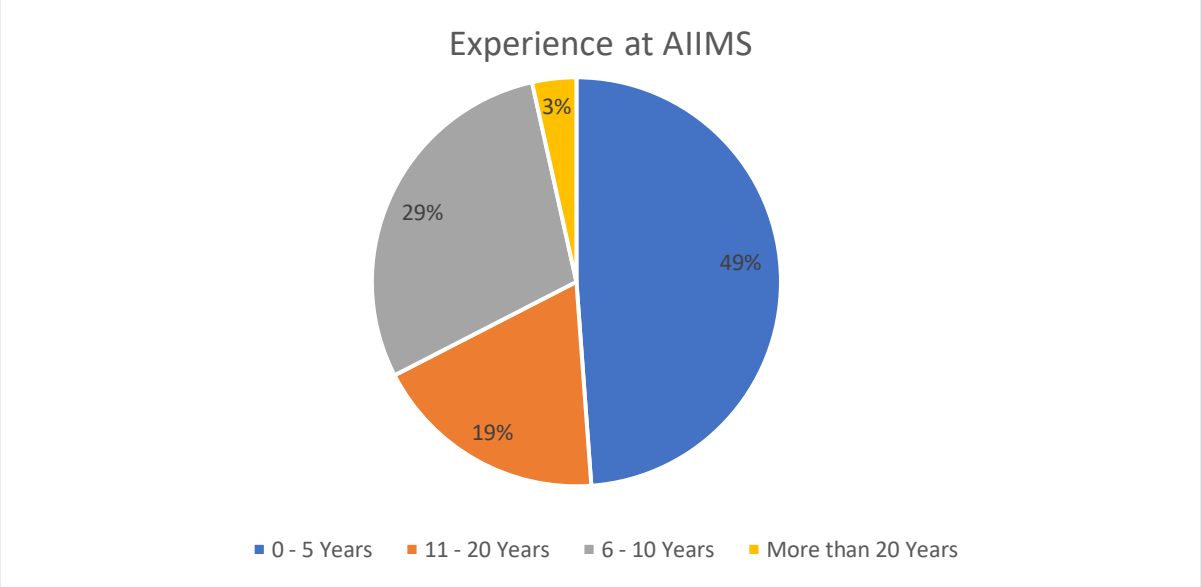
A total of 32 Doctors had given feedback, which could be classified into 3 categories: People, Process and Technology.

S.no	Feedback Received	No. of Responses
People		
1	Insufficient Manpower	3
2	Hospital is not patient friendly as it should function as a tertiary care hospital, not a primary care hospital	12
3	Biometric attendance and display of ID cards mandatory to all employees	5
4	Inadequate training and services of the IT People in the hospital.	15
Process		
1	Filmless and paperless Radiology services	17
2	Efforts should be made to eliminate physical registers for record entry	20
3	Retrieving data records from register is tedious and long process.	29
4	Administrative work is more, due to which cannot give the needed time to patients.	8
5	Patient Tracking is very difficult	9
Technology		
1	PACS and RIS needs special consideration	4
2	System needs to be made user friendly	11
3	Patient records should be fully digitised	17
4	Single sign on system	14
5	Poor network connectivity	15
6	Remote access to HMIS	7
7	One Integrated solution	4
8	Interoperability should be present	9
9	Barcode generation process may be evolved to accommodate payment verification	2
10	The systems should be easy to navigate, and remote access should be possible when needed	4
11	Should have EMR system which will be easy to operate	25
12	Patient care portal needs to be upgraded. It should be smooth and timebound	6
13	Real time updating of patients' IPD location and Treating Physician should be available to Labs to facilitate communications regarding critical results and possible pre-analytical problems	10
14	In case of Edits in released reports patient (for OPD reports) and concerned clinician (for IPD) to be informed through alerts/notification.	5
15	Real time updating of patients' IPD location and Treating Physician should be available to Labs to facilitate communications regarding critical results and possible pre-analytical problems	10

3.1.3. Nursing Officer

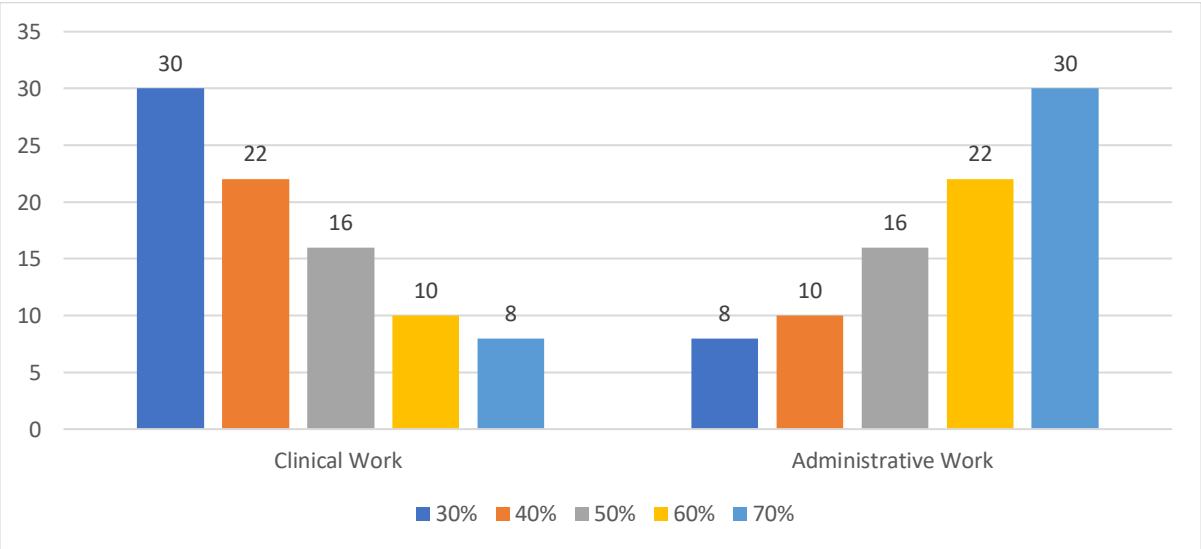
Experience at AIIMS

Experience	No. of Responses
0-5 years	42
6-10 years	25
11-20 years	16
>20 years	3



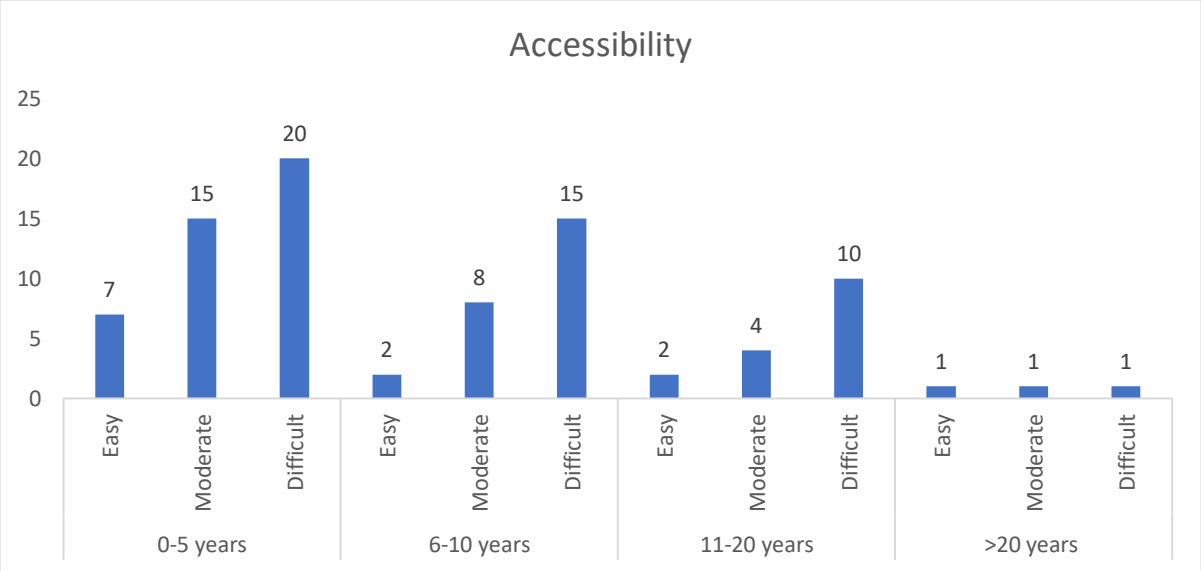
Time spent on patient care and administrative work

Duties	No. of Responses				
	30%	40%	50%	60%	70%
Clinical Work	30	22	16	10	8
Administrative Work	8	10	16	22	30



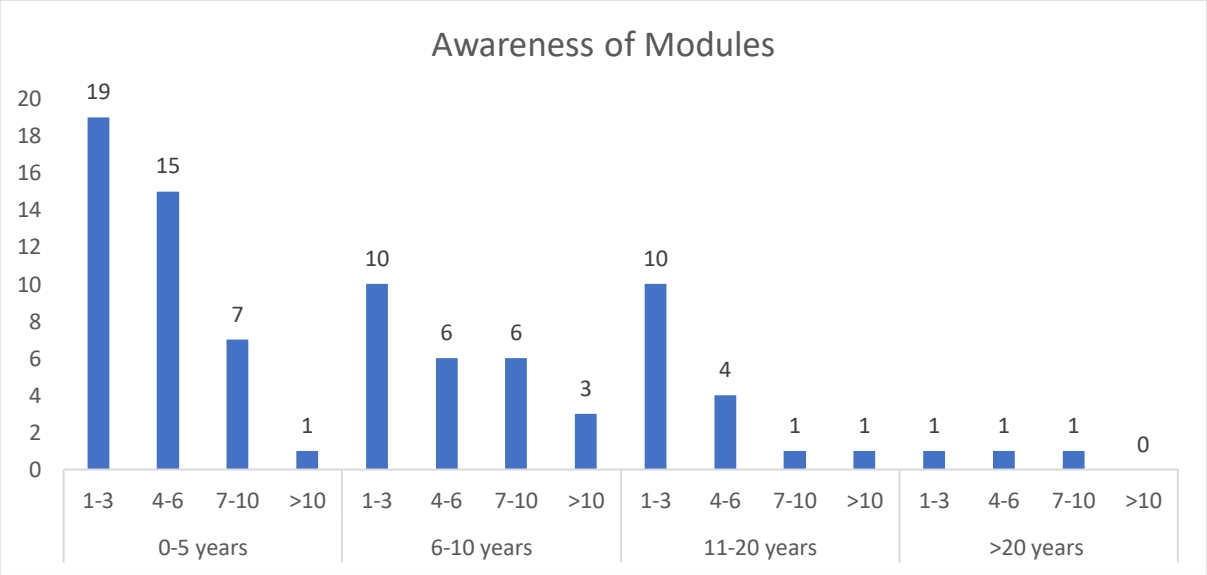
Accessibility of eHospital

Experience	Accessibility	No. of Responses
0-5 years	Easy	7
	Moderate	15
	Difficult	20
6-10 years	Easy	2
	Moderate	8
	Difficult	15
11-20 years	Easy	2
	Moderate	4
	Difficult	10
>20 years	Easy	1
	Moderate	1
	Difficult	1



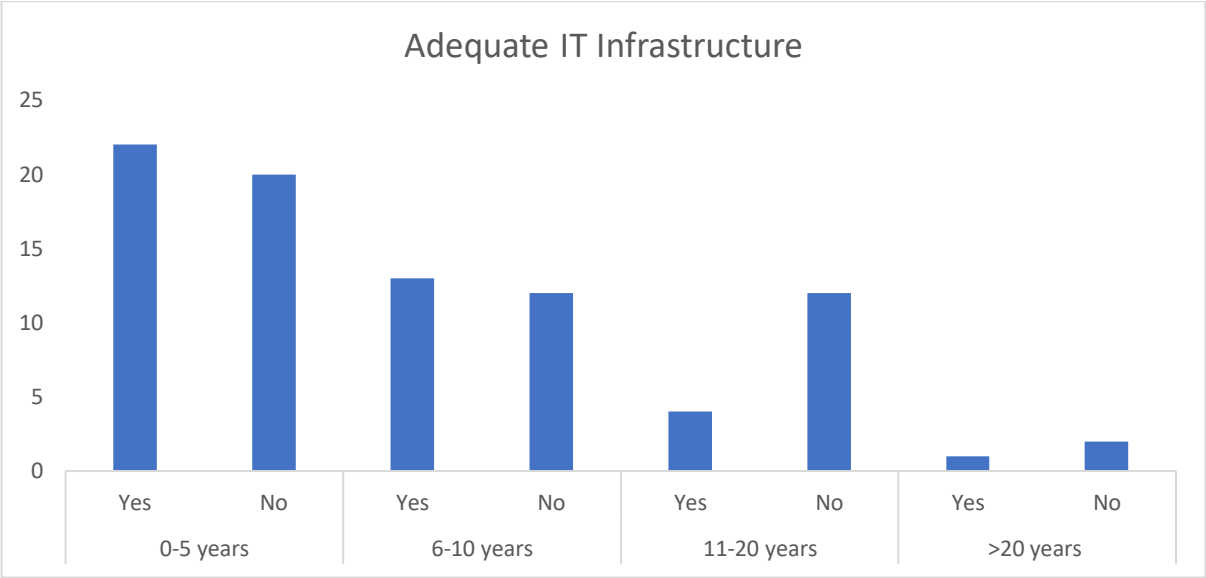
Knowledge about the Modules in eHospital

Experience	No. of Modules	No. of Responses
0-5 years	1-3	19
	4-6	15
	7-10	7
	>10	1
6-10 years	1-3	10
	4-6	6
	7-10	6
	>10	3
11-20 years	1-3	10
	4-6	4
	7-10	1
	>10	1
>20 years	1-3	1
	4-6	1
	7-10	1
	>10	0



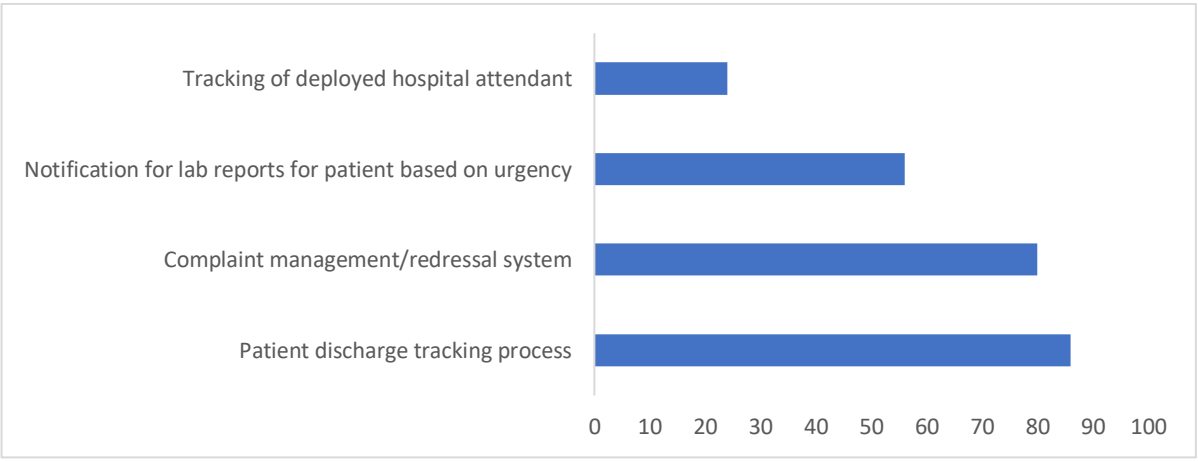
Do you have adequate IT Infrastructure?

Experience	Adequate Infrastructure	No. of Responses
0-5 years	Yes	22
	No	20
6-10 years	Yes	13
	No	12
11-20 years	Yes	4
	No	12
>20 years	Yes	1
	No	2



Features needed in HIS

Features	No. of Responses
Patient discharge tracking process	86
Complaint management/redressal system	80
Notification for lab reports for patient based on urgency	56
Tracking of deployed hospital attendant	24



Feedback

A total of 46 Nursing Officers had given feedback, which could be classified into 3 categories: People, Process and Technology.

S.no	Feedback Received	No. of Responses
People		
1	Insufficient Manpower	10
Process		
1	Improve the transfer process of patients from different departments, hospitals	15
2	Efforts should be made to eliminate physical registers for record entry	25
3	Roster Management is done on "gatta"	12
4	Hybrid maintenance of records	17
5	Duplicacy of work	22
6	Time bound services	11
7	Indent process to be improved -The expiry date of the medicine isnt visible when we put an indent in medical store indent and stock should be updated.	17
Technology		
1	One Integrated solution	10
2	Application for leave management, tuition fees	14
3	Integrate all the application with sso or fingerprint login	9
4	Fast browser	5
5	Grievance portal should be implemented	9

3.2. Activity Diagram

3.2.1. Existing Process

3.2.1.1. OPD

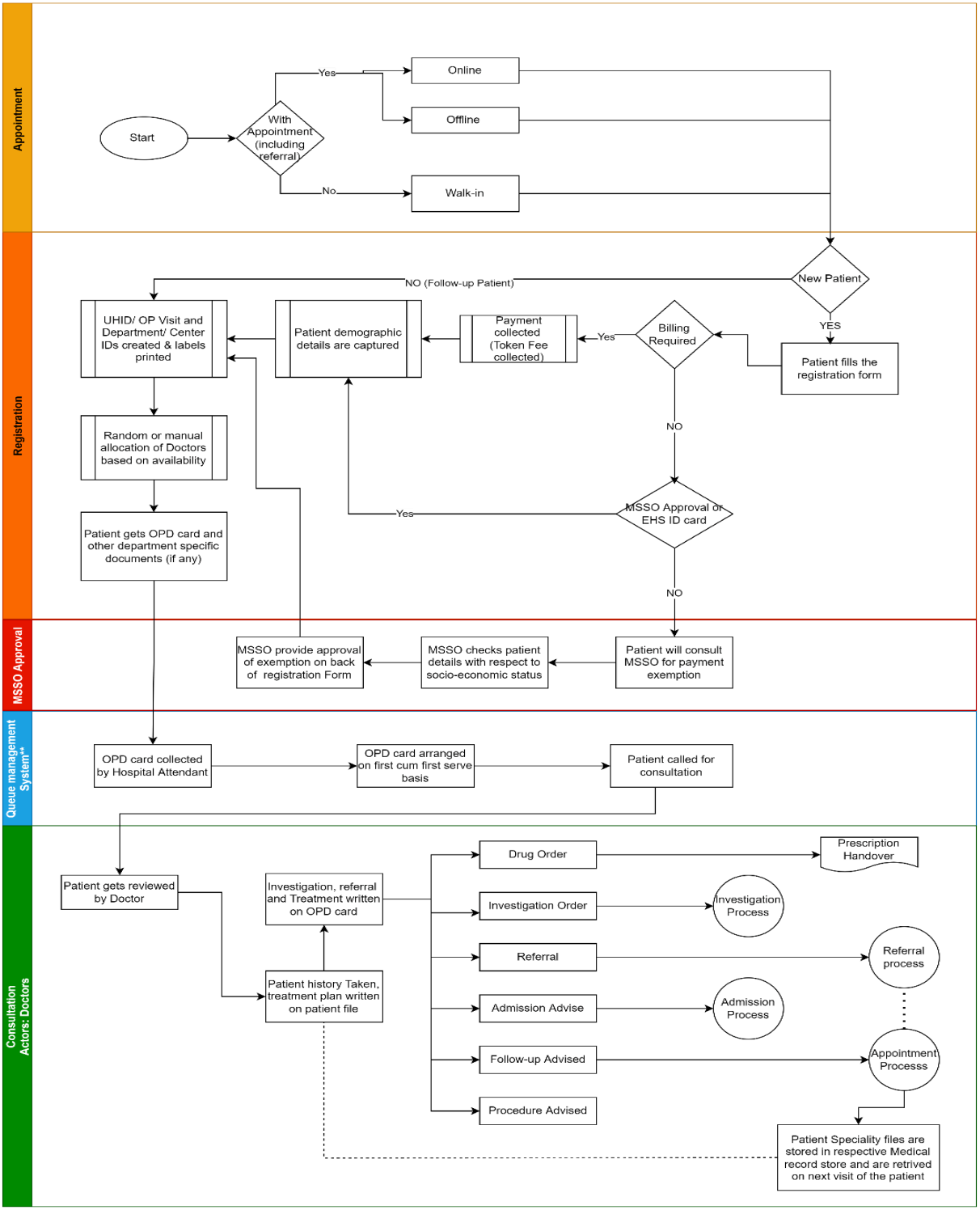


Figure 1 OPD Workflow

3.2.1.2. IPD

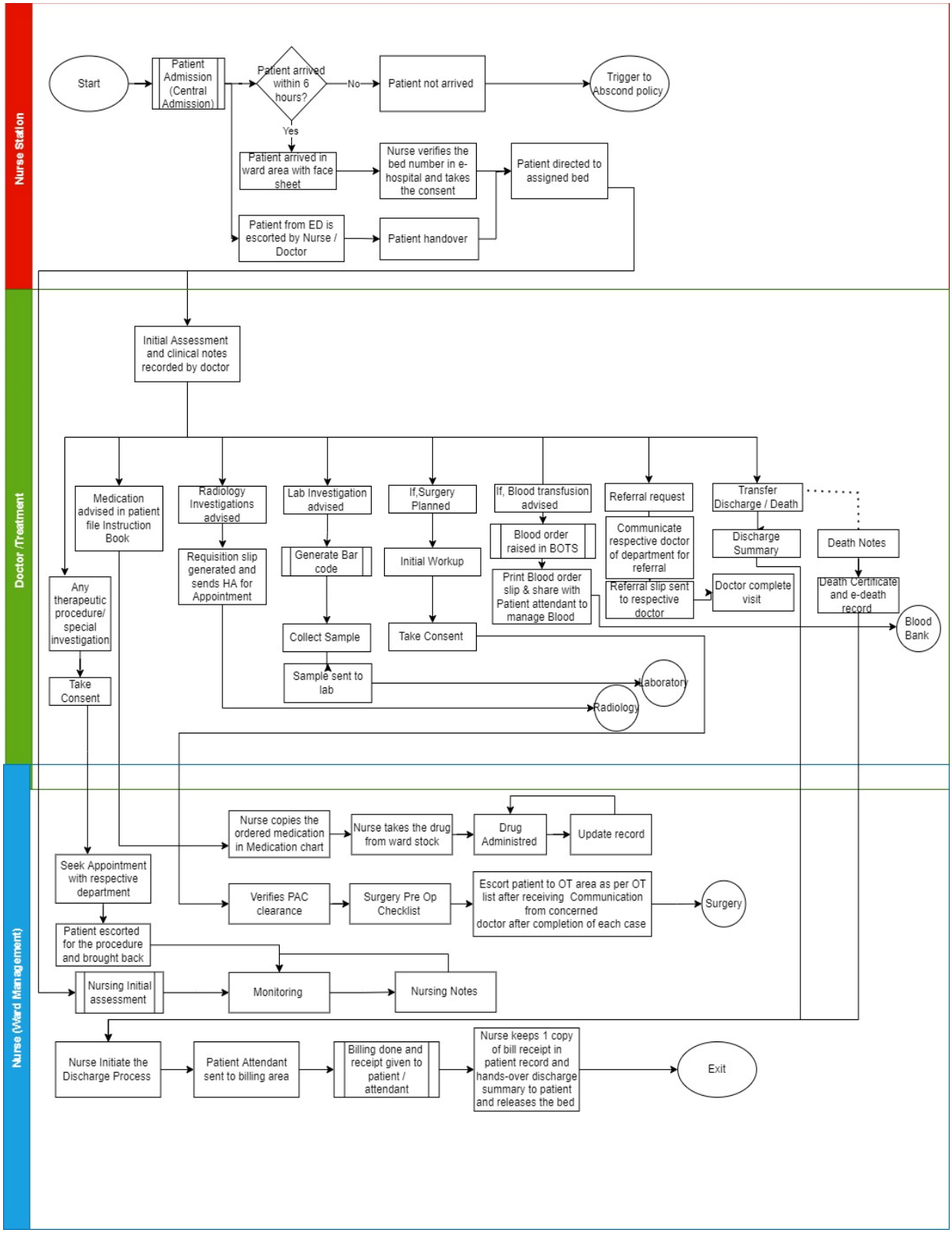


Figure 2 IPD Workflow

3.2.2. New Process

3.2.2.1. OPD

OPD Workflow

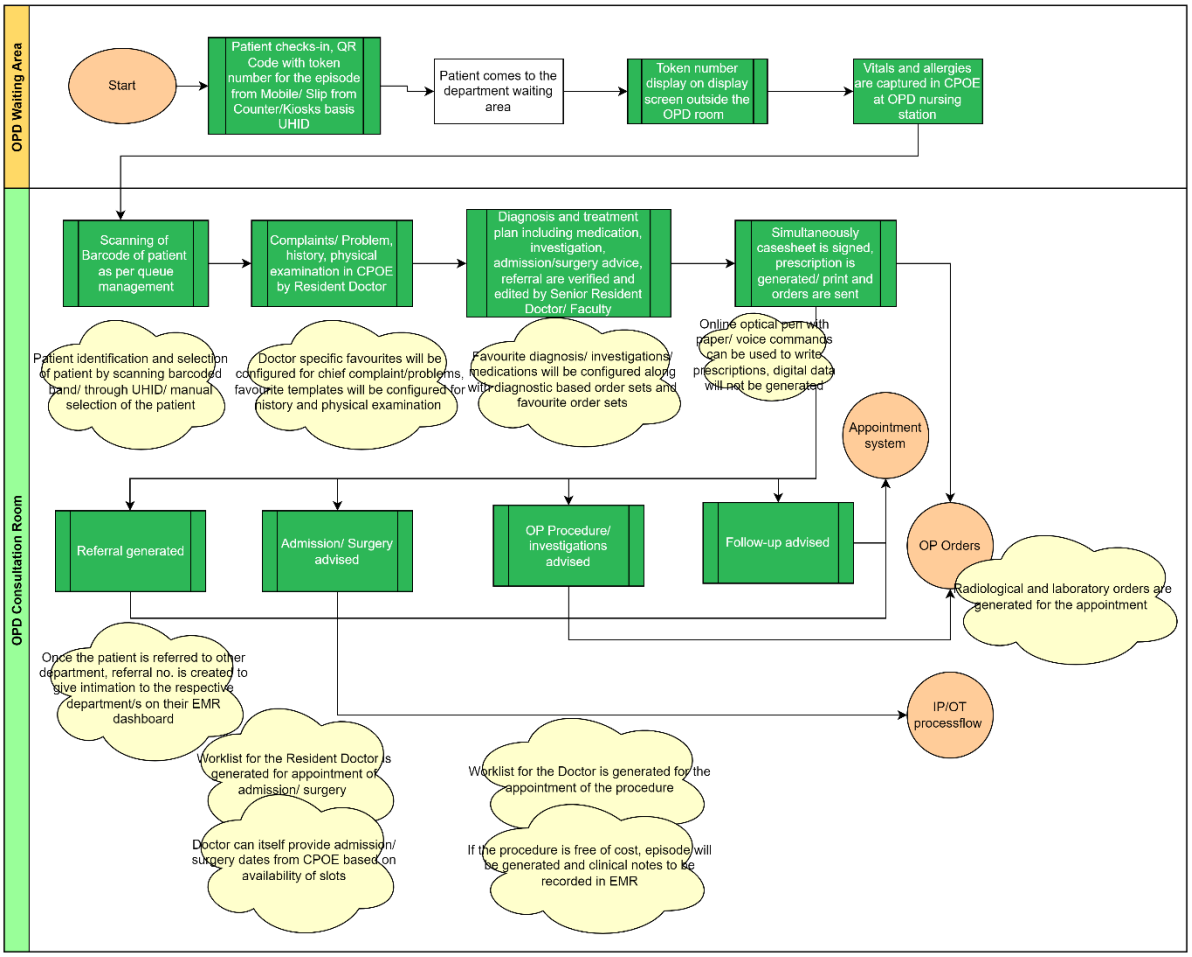


Figure 3 OPD To Be Workflow

3.2.2.2. IPD

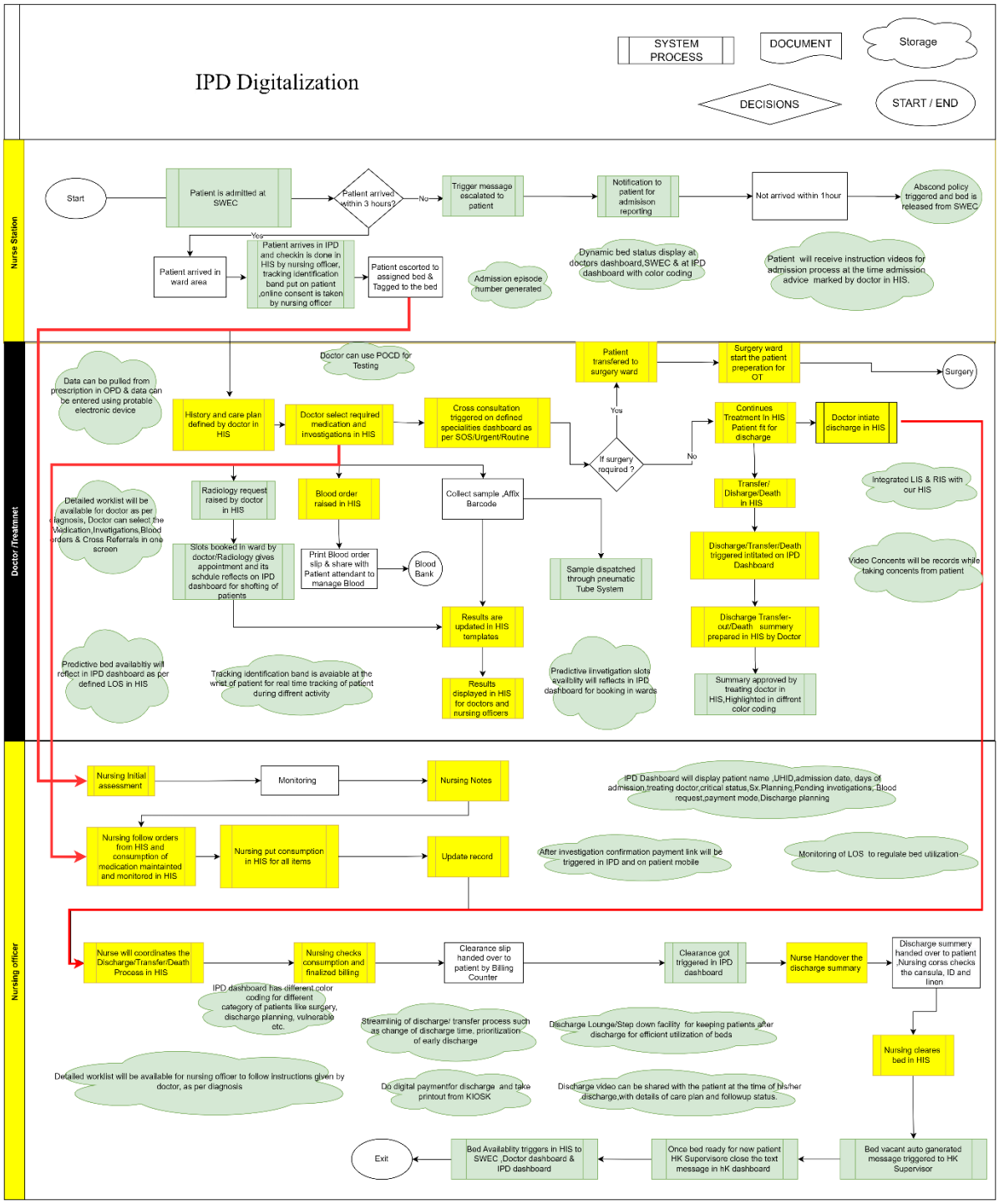


Figure 4 IPD To Be Workflow

3.3. Functional Requirements

3.3.1. OPD

1. **Registration and Appointment**
   - 1.1. Patient should be able to register using QR Code or through mobile application by providing their details.
   - 1.2. Patient should be able to schedule an appointment with doctor and pay the fees through the application
   - 1.3. The system should be able to display the patient's details and UHID on display screen and sequence the patients according to the appointment slots and time.
   - 1.4. The system should be able to record the patient's vitals before doctor's consultation.
2. **Consultation**
   - 2.1. Doctor should have access to the patient's records and is able to view the patient's UHID and vitals on the system.
   - 2.2. Doctor should be able to record the patient's history, diagnosis, and treatment plan in the system.
   - 2.3. Doctor should be able to prescribe medications and send them to the pharmacy through the system.
   - 2.4. Doctor should have the option of tele-consultation in the system.
   - 2.5. Doctor should be able to place requests for tests -radiology and laboratory in the system.
3. **Test Results and Referral/transfer of patient**
   - 3.1. Doctor should be able to view the patient's test results in the system.
   - 3.2. In case of referral, doctor should be able to place a request to the specific department using the system.
   - 3.3. In case of admission, doctor should be able to initiate the admission process in the system.
   - 3.4. Doctor should be able to schedule a follow up for the patient in the system.

3.3.2. IPD

1. **Admission**
   - 1.1. The nursing officer should be able to view the admission of the patient in the system.
   - 1.2. The nursing officer should be able to check in the patient and place RFID Tag/Bar code through the system once the consent is taken.

1.3. The nursing officer should be able to send alerts to the patient in case of no show of patient within the time for admission for the patient.

1.4. The nursing officer should be able to place a request for the release of bed when the patient doesn't arrive for admission.

2. Doctor's Consultation

2.1. The doctor should be able to access the patient's OPD Records through the system.

2.2. The doctor should be able to record the history and care plan of the patient into the system.

2.3. The doctor should be able to place requisition for medications, lab tests, radiology tests, blood orders that should be reflected on the nursing officer and investigation counter's dashboard though the system.

2.4. Doctor should be able to place a request for cross referral through the system.

2.5. In case of surgery advised, the doctor should be able to place an order for PACS Clearance though the system, which should be also shown in the OT's dashboard.

2.6. Doctor should be able to monitor the patient's vitals through the system.

2.7. In case of discharge, the doctor should be able to place a request for it in the system which should reflect on the nursing dashboard.

2.8. Doctor should be able to prepare a discharge summary in the system.

3. Nurse Rounds

3.1. Nursing officer should be able to view the patient's medication chart and update the chart using the system once drug is administered in the patient.

3.2. Nursing officer should be able to initiate the process of pre-op checklist for the patient in the system.

3.3. Nursing officer should be able to send the discharge request to the billing dashboard through the system.

3.4. Nursing officer should be able to place a request for bed maintenance once the patient is discharged though the system.

3.4. Use Case

3.4.1. OPD

Context level Diagram

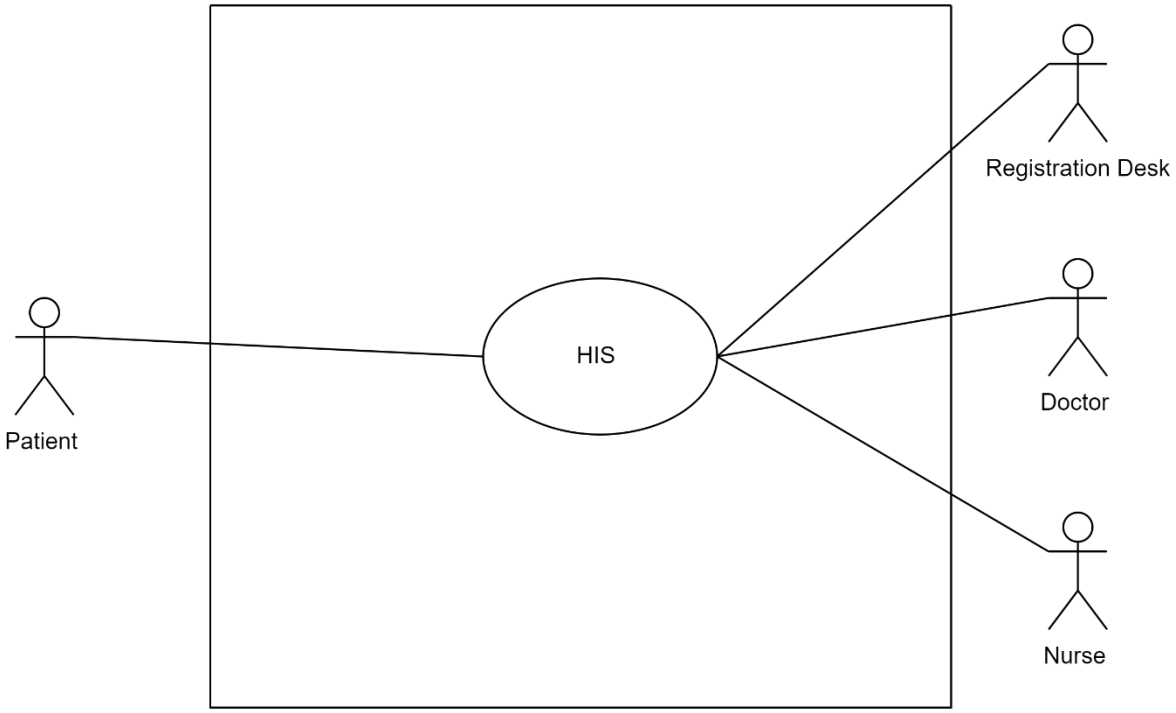


Figure 5 Context level Use Case

Level 1 Diagram

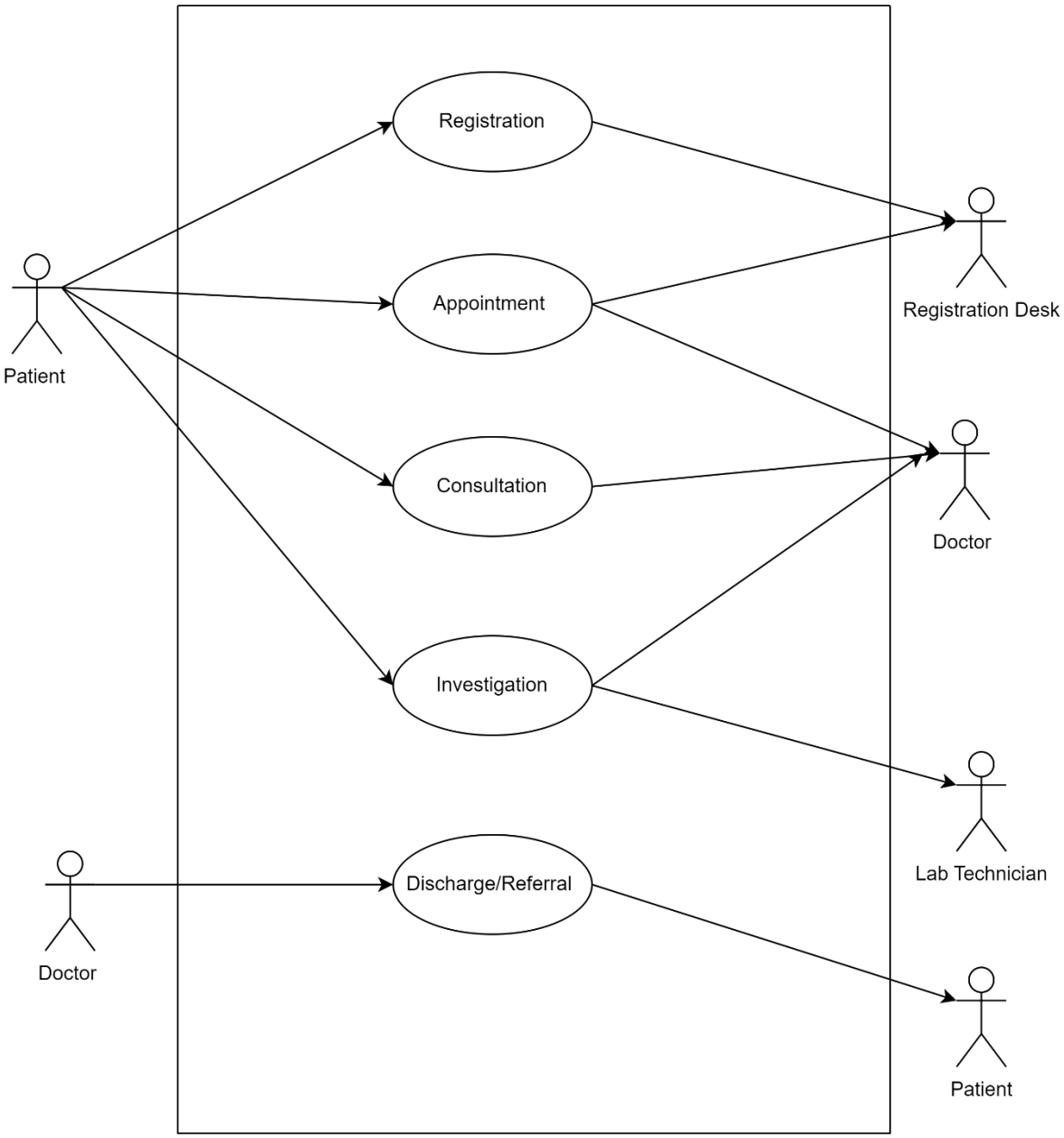


Figure 6 Level 0 Use Case

Level 2 Diagram

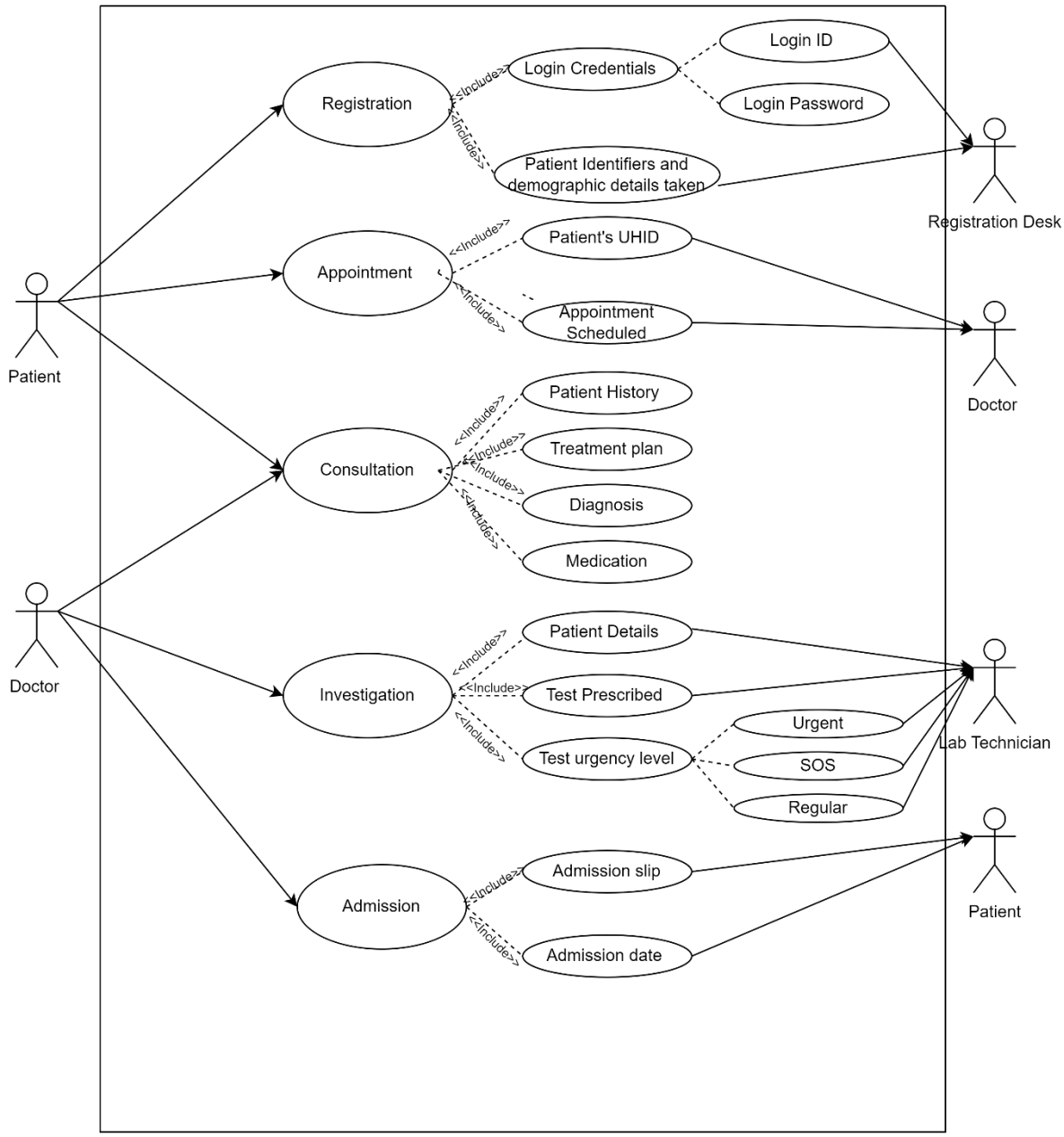


Figure 7 Level 1 Use Case

3.4.2. IPD

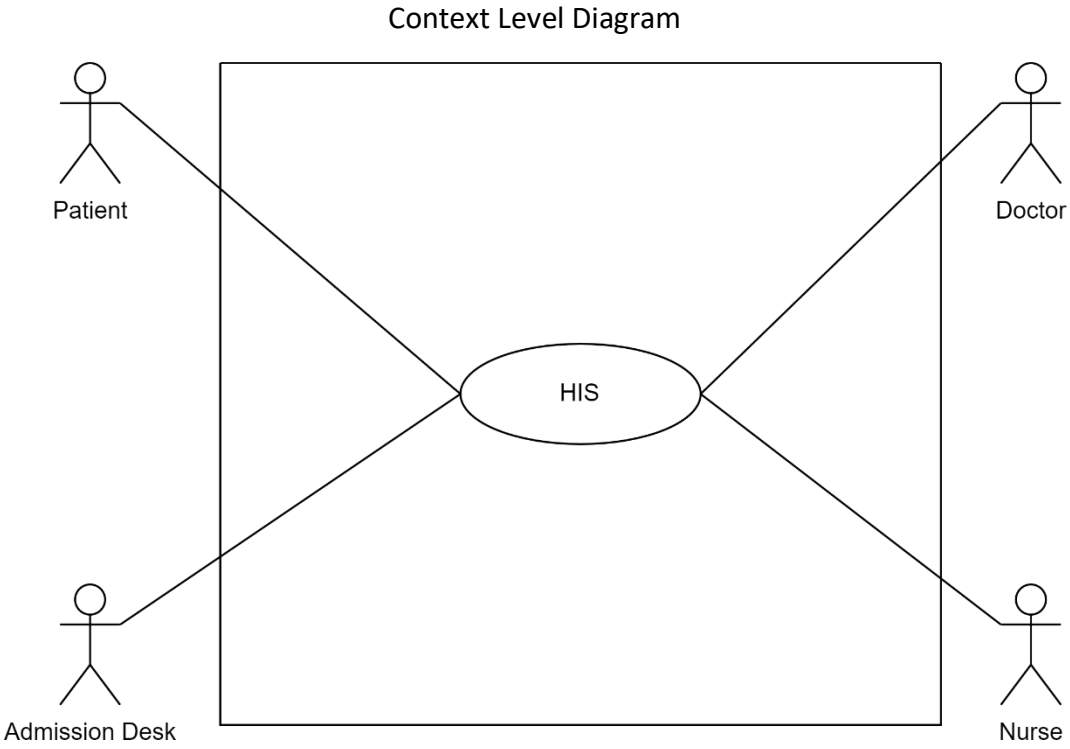


Figure 8 Context level Use Case

Level 1 Diagram

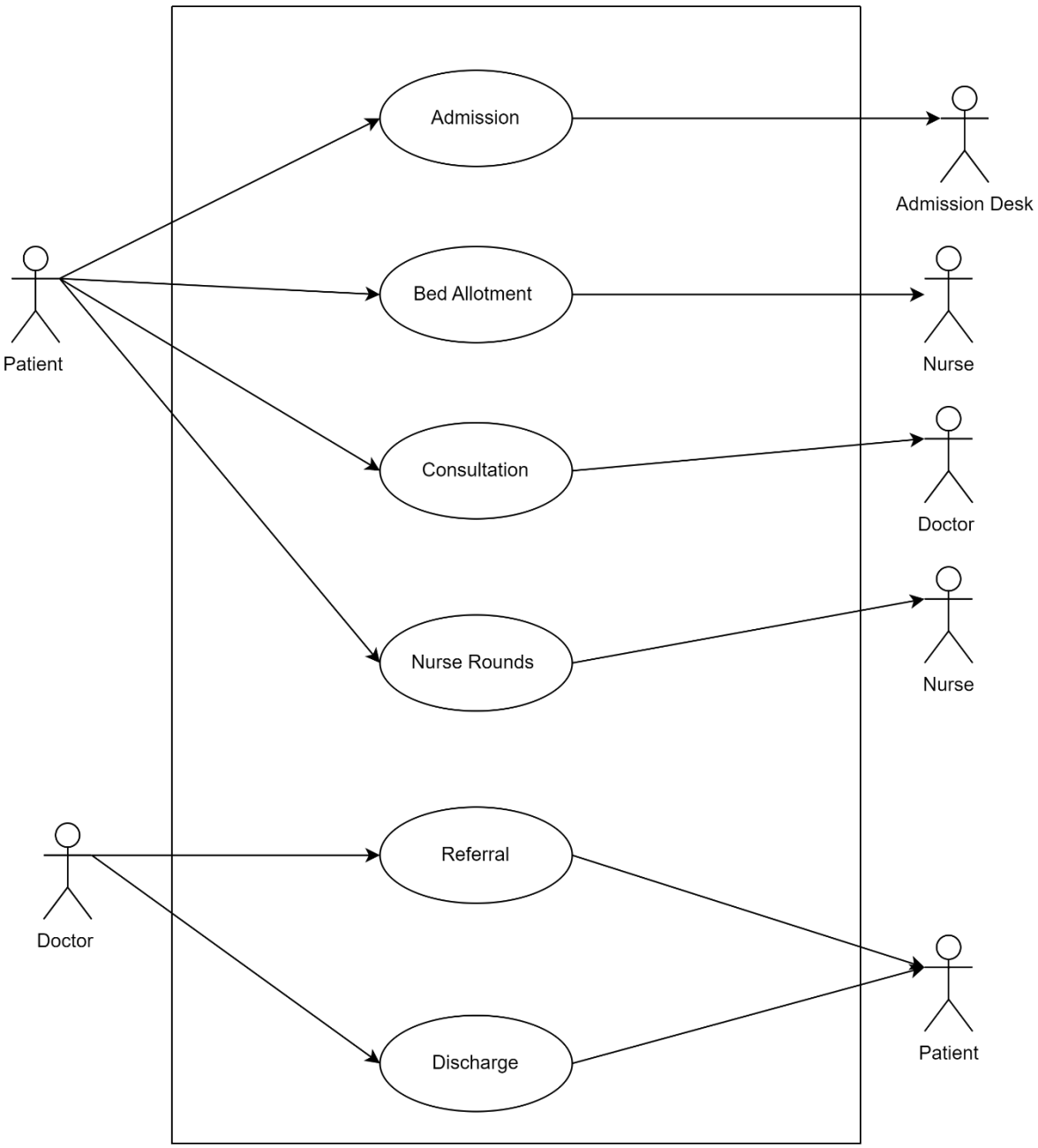


Figure 9 Level 0 Use Case

Level 2 Diagram

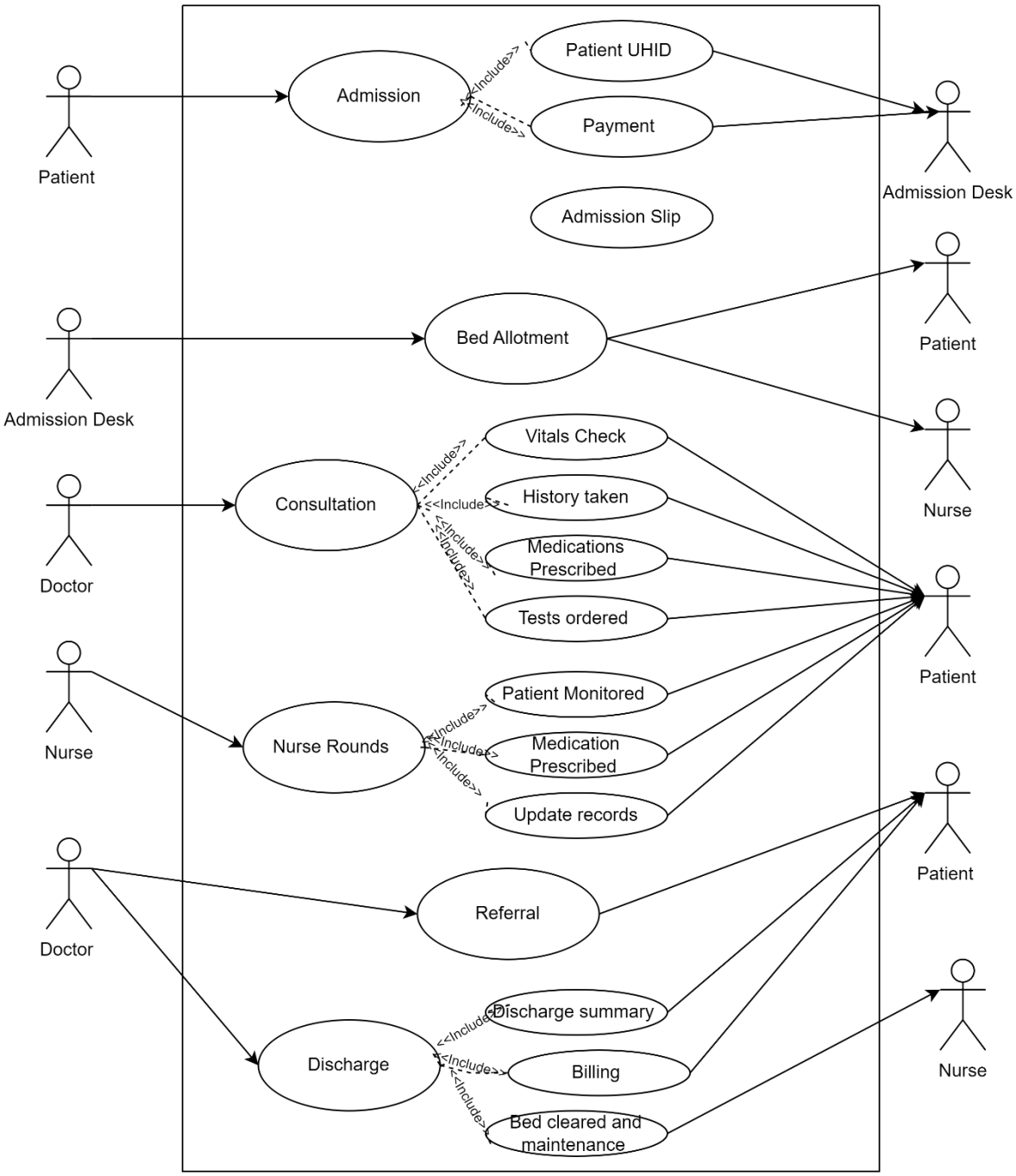


Figure 10 Level 1 Use Case

3.5. System Requirements

3.5.1. OPD

1. **Check in and Queue Management**
    - The system should be able to configure outpatient spaces for the clinic(s)/doctor(s).
    - The system should enable users to check in through
        - SWEC
        - Kiosk.
        - Mobile app (same geo-fencing area)
        - Kiosk barcode reader (paper slip or phone (Mobile app)) for OPD consultation service for which the user has made an appointment within the configurable time range.
    - The token number, along with other data, will be displayed on the queue management display, along with the doctor's name and room number, as well as the status of the consultation and the approximate waiting time.
    - The system should be able to configure the queue list depending on the following criteria: 1. appointment time 2. check-in time 3. Time of appointment vs. token number
2. **Pre-Consultation**
    - Prior to consultation, the system should allow the user to enter vitals, allergies, and other information.
    - The user must be able to view the patient base queue's OPD or worklist.
    - The system should be able to tag scanned documents (prior patient records) with UHID.
    - The system should also offer separate electronic queue management for pre-consultation and consultation.
3. **Consultation**
    - Within the doctor module's dashboard, the user should be able to view OPD appointments/ OPD patients (patient in line and patient visited)/ IPD patients- (admitted and discharged)/ ER patients/ Referral patients (referral received and referral sent).
    - The system shall be able to alter the state of the queue on the queue management display based on the user's work on the patient's case sheet.
    - The system should allow the user to record the current episode's complaint/problem, the patient's history, physical examination, and additional examinations as specified in the speciality templates. Within the history and physical examination, the system should allow the user to pick and edit note style templates. The system must additionally allow the user to record the details using the following (but not limited to) features. - Speech to text, write to text through digital pad, template, and other relevant tools/ method.
    - The system should allow users to access previous treatment data, investigation findings, allergies / health issues, and so on. The user should be able to access the necessary information with a single click.

- The system should enable the user to pick the appropriate portion of the screen for inputting diagnosis, treatment plans, investigations, minor procedures, medications, referrals, and follow-up (including appointment scheduling), among other things.
- Once the patient has described his or her ailment, the user should examine the patient, review any previous records, and enter the clinical impression/provisional diagnosis (based on ICD-10 / 11 coding or any other standard coding), advised investigations, medicines, and follow-up (if any) into the system.
- The system should also allow users to annotate on pre-uploaded photographs or images obtained during the patient's session. The system should allow the user to choose the information and send them to the appropriate departments. The user should be able to choose an open slot and, if necessary, schedule a radiological investigation.
- The system should allow the user to mark the patient MLC with specifics.
- The system should allow the user to transmit the request to the admission counter dashboard, along with the registration data and any other necessary information.
- If the doctor orders a follow-up visit after a certain number of days, the system should be able to schedule it automatically. The system should be capable of providing follow-up as a teleconsultation. The patient would only view the teleconsultation slots if a follow-up teleconsultation was recommended for the next appointment.

4. **EMR**
    - The system should allow for the sequential viewing of a patient's past medical records, which should be accessible for the rest of the patient's life. The system should provide the ability to view EMR.
        - Consultation by episode
        - Investigation by episode
        - Episode-by-episode procedure

      There should be a way to compare investigation reports and analyse vitals and investigation parameters trends.
    - System should support digital signature/consent for OP procedure to be carried out
    - System should support configurable dashboard and MIS reports

1.5.2. IPD

1. **Nursing Station**
    - The system should allow the user to admit the patient to the ward after ensuring that all prerequisites are satisfied, such as billing clearances, clinical conditions, bed availability, and so on.
    - The system will have an IPD Dashboard with comprehensive patient information organised by unit. (UHID, name, age, gender, diet, diagnosis, investigation status, procedure, radiology, blood bank, payer category, and so on.)

- The IPD Dashboard will use distinct colour coding to represent the patient's status for any worklist pendency.
- The system must indicate the ward's daily pending IP admissions.
- The pending admission patient who has completed the admission process shall be able to check-in to the system.
- After checking in, the system will create an admission episode number (IP visit number).
- The system will display the status of a patient's check-in in the IPD dashboard.
- The technology shall enable users to grant consent by signing on a digital signature pad.
- After checking into the IP ward, the system should be able to produce a patient tracking ID (Admission number). This will be printed in the form of a barcode (both standard and wrist band).
- The system shall be able to associate the patient's tracking ID (Admission number) with the patient's UHID in the system.
- The system will be able to tag the patient with the bed number (reservation/assignment) and the status will be reflected in the IPD Dashboard.
- The system will be able to tag the patient with the bed number (reservation/assignment) and the status will be reflected in the IPD Dashboard.

2. **Treatment of Patient**
    - The system enables the user to do inpatient clinical assessments
    - The system may present the patient's EMR's longitudinal perspective.
    - The system allows the user to design a treatment plan for an IP patient.
    - On the physicians' instructions, the system will be able to transform all OP orders into IP orders.
    - The system will be able to track the execution of medicine and investigative instructions issued by a nursing officer on a patient.
    - The system allows the user to place CPOE orders for the IP patient (lab, radiology, diagnostic services, operations, and so on).
    - The system allows the user to print barcode labels for containers used to collect blood, urine, and sputum samples from patients.
    - The system allows the user to label a patient's samples (blood, urine, or sputum) as collected or unavailable
    - The system will allow the user to submit lab orders in the LIS and subsequently print barcodes for sample vials from nurse stations.
    - The system will be able to update the status of lab requests and sample collection in relation to the doctor's lab order.
    - The system will be able to display doctors any pending lab order for barcode printing and sample shipment alerts.

- The system will be able to process blood requests submitted by doctors.
- The user can make daily medication orders for the patient using the system.
- The system allows the user to assign diagnosis codes for the patient using ICD10 or the most recent codes.
- The user can utilise the system to create a cross-consultation request for the patient.
- The system enables the user to refer the patient to another speciality or a specific consultant from another speciality within the unit or to any other unit in the department.
- The system will be able to use the patient's data to perform the first assessment/treatment planning for that patient in IPD.
- The system will be able to generate care plans based on patient data, diagnoses, and conditions.
- The system can display the lab orders, radiology orders, other investigations, and procedures entered when the admission request was created.
- The system might approve the pending orders of the admittance request.
- The system should be able to show physicians' directives to nursing officers. Pending, sought for, halted / suspended, and finished are the order statuses.
- The system allows the user to update the status of a pending order (lab, radiology, procedure, etc) as stopped / suspended / completed.

3. **Medication Administration**
    - The system will be able to assist CDSS (Clinical Decision assist System) and give significant pharmaceutical information (for example, drug interactions, Narcotics, antibiotic guidelines, and so on).
    - The system offers the option to pick drugs from a drop-down list associated with that illness.
    - In the IPD dashboard, the system will be able to display drug administration records**.**
4. **Patients' bed/department/OT transfer requirement**
    - The system will be able to begin the transfer request to another department.
    - The system will be able to accept a transfer to a different ward or doctor.
    - The system will be able to produce surgical requests, which will be shown on the IPD Dashboard.
    - The system would be able to initiate OT cooperation with other departments such as food, OT, CSSD, linen, and anaesthesia, among others.

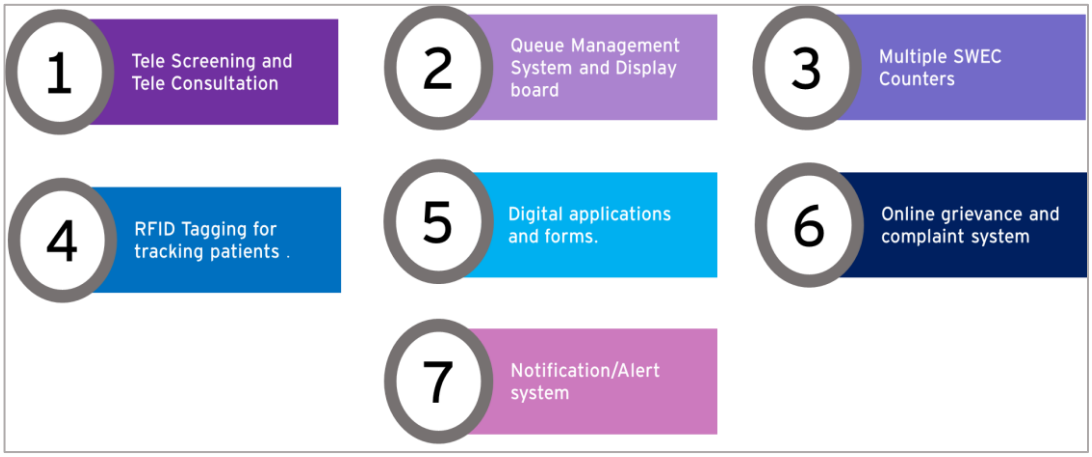
- The system will be able to deliver autogenerated alerts about the patient's billing status to the patient's mobile device at predefined intervals.
- All costs, investigations, procedures, surgical charges and consumables, pharmaceutical orders, inventories, doctor visit charges, and daily bed charges will be able to be posted to the patient's UHID account.
- The user will have the ability to view all pending charges of a patient.

5. **Patient Discharge Process**
    - The system will be able to recommend discharge for any patient.
    - The system will be able to generate a discharge summary automatically based on the patient's paperwork during their stay, with the flexibility for the user to make changes or add new material as needed. Discharge summary, for example, displaying data from clinical notes/progress notes, test results, radiological results, drugs dispensed, operation performed, and so on.
    - Every visit's medical record will be shown via the system.
    - The system will be able to transmit discharge notifications to the IPD dashboard.
    - The system will be able to cross-reference consumption and investigations on the IPD dashboard.
    - After the clearance has been provided for all commodities consumed / processes performed / diagnostic tests conducted with report, the system will be able to immediately submit the pending discharge bill to the user for settlement.
    - The technology will be able to send an alert to the patient's mobile device for bill settlement.
    - The system will allow the user to pay their outstanding account using a mobile app, portal, or kiosk.
    - The system will be able to deliver payment clearing slips on their mobile device or web, as well as print payment clearance slips from the kiosk.
    - After the payment is completed by the patient, the system will be able to give billing clearance, which will be shown on the IPD dashboard.
    - The system will be able to digitally sign off on the discharge summary. The status of the discharge summary will be shown on the IPD dashboard.
    - The system will be able to create discharge timelines in the system, such as transfer, prioritisation, early discharge, and so on, which will be shown on the IPD dashboard and visible to carers.
6. **IPD bed management post discharge**
    - Once billing approval is received from the patient, the system will be able to release the bed for cleaning and bed making in the IPD

dashboard. When a patient is physically dismissed, he or she must automatically go for cleaning and maintenance.

- For cleaning and bed making, the system will send an autogenerated bed clearance notification to HK personnel.
- The system will be able to restrict the bed for cleaning and making, and this will be reflected in the IPD Dashboard.
- Once HK Staff has completed their duties, the system will be able to release the bed.
- The system will be able to provide bed availability on the IPD dashboard.
- The system will be able to analyse bed availability and ALOS.

Suggestions given:



2. Discussion

It was observed that, about 55% of the patients had a higher waiting time for completing the registration process. This was observed because there was no separate queue for new patients and follow up patients. It was also observed that even with the appointment scheduled for follow up, those patients still had to wait in line for the registration process. Due to this, it was seen that due to such a large influx of patients, there was overcrowding present in the registration areas. Because of a lack of a queue management system, and without knowing when it would be their turn, patients crowded the waiting room or the front desk. Research suggests that there is a direct relation with the waiting time and patient satisfaction levels. By making the registration and appointment process online, it was seen that waiting time at the online registration window was substantially less and patient satisfaction was significantly more than those who were opting for walk-in registration. (10)

After completing the registration process, around 59% of patients had to wait longer to see the doctor. It was also observed that many patients were unsatisfied with the amount of time allotted by the doctor; 74% of new patients and around 70% of follow-up patients had brief consultations with the doctor. According to a research study, Patients with low total waiting time and high consultation time have satisfied more than the patients with a high total waiting time and low consultation time. Introducing a pre-booking system and pre-screening of patients for the outpatient department might reduce unnecessary waiting times at registration and waiting areas. (11)

The most significant barrier to patient responses was overcrowding. According to research, patient satisfaction, clinical outcome, and symptoms may all be impacted by overcrowding. Additionally, it may lessen a doctor's effectiveness, frustrating the rest of the medical team. (4) A token display system and an electronic queue management system should be available to direct patients to the appropriate location. According to research, using a queue management system in waiting areas can shorten both actual and perceived wait times and boost patient satisfaction. (5)

It has been noted that doctors spend less time with patients because of their excessive administrative, academic, and research commitments. Roughly 47% of physicians spend between 30 and 40% of their time on administrative tasks and roughly 55% of physicians devotes 10 - 20% of their time on clinical work. Research suggests that physicians who reported higher percentages of time spent on administrative duties had lower levels of career satisfaction, higher levels of burnout, and were more likely to be considering seeing fewer patients in the future. (12)

The hospital is only partially digitalized, and it was discovered that many clinicians were unaware of the various software modules even after eHospital was implemented there. Only 9% of doctors were familiar with more than 10 modules of eHospital,

compared to 46% of doctors who only knew about 1 to 3 of the software's modules. Additionally, it was noted that the eHospital software was challenging to utilise since it hadn't been customised to the hospital's requirements. Only 20% of the doctors said it was simple to use the eHospital software, while 80% of the doctors said it was challenging.

The physicians were seen keeping patient records manually in several registries as well as electronically at the eHospital. 90% of the doctors said it was very difficult to retrieve data from the archives. Most of the patient data that was gathered at the hospital was kept in the registers, making it a very tedious and time-consuming procedure for retrieving the data.

Since the hospital is only partially digitalized and the software used there is not integrated, it can be challenging to communicate with other departments and to get patient information from other departments via the current online system. A customised EMR/EHR system should be built, according to about 78% of doctors. According to research, the implementation of EHRs improved patient care overall by enabling remote access to a patient's file and warnings about potentially dangerous prescription dosages and harmful test results. (6)

It was also observed that there was duplication of work from both doctors and nursing officers. The nurses would record the doctor’s instructions present in the instruction register to the treatment register. Their time which was supposed to do be spent on patient care was busy in doing their administrative work, maintaining the duty roster, and maintaining the different registers. It was observed that 79% of nursing officers spent on about 50-70% of their time doing administrative work.

Research suggests that in the healthcare sector, storing the duplicated records leads to wrong prediction. Making special algorithms that would help in removing duplicate data must be utilized in the system. (13)

It was observed that 79% of nursing officers spent on about 50-70% of their time doing administrative work. Research showed that the NIS could be a tool to support them in improving patient care, and medical documentation. (7)

Increased patient loads, resulting in increased frequency of nursing tasks and non-nursing tasks, were positively correlated to incompletion of nursing activities during the shift. (8) The administrative duties, along with maintaining various manual registers increased the workload of the nurses. Research shows that Increased patient loads, resulting in increased frequency of nursing tasks and non-nursing tasks, were positively correlated to incompletion of nursing activities during the shift. (9)

3. Conclusion

For the effective deployment of technology-driven solutions, the process of requirement gathering for the digital transformation of the Outpatient Department (OPD) and Inpatient Department (IPD) in a tertiary care hospital is vital. The hospital can make sure that the digital transformation plan is in line with its goals and delivers substantial advantages by carefully assessing the demands and difficulties of both patients and healthcare providers.

The hospital can identify critical areas where technology can improve patient care, streamline operations, and increase overall efficiency through effective requirement collection. The use of electronic health records (EHRs) to digitise and centralise patient data, the creation of online appointment scheduling services to shorten wait times and improve patient comfort, and the incorporation of telemedicine services to allow for remote consultations and follow-ups are a few examples of what this could include.

It is crucial to involve stakeholders in the requirement-gathering process, such as physicians and nurses. Their suggestions and insights will help us gain a thorough understanding of the current procedures, their shortcomings, and possible areas for change. Collaboration between these parties will aid in creating a roadmap for digital transformation that considers the requirements of the hospital and its patients.

To make sure that patients' expectations, desires, and concerns are taken into consideration, the requirement-gathering process should also incorporate getting patient feedback to help mould digital transformation plan to meet their requirements. The success of the digital transition can be increased by including patient-focused organisations and adopting patient-centric design principles.

Additionally, the process of obtaining requirements needs to take things like data security, interoperability, scalability, and regulatory compliance into account. In order to preserve patient confidentiality and confidence, it is essential to make sure that the chosen digital solutions comply with applicable privacy laws and industry standards. In order to maximise the long-term advantages of the digital transformation programme, integration capabilities with existing systems and the possibility for future scaling should also be taken into account.

A tertiary care hospital may build a solid basis for the successful digital transformation of its OPD and IPD by efficiently gathering requirements, integrating key stakeholders, and taking patient feedback into account. This transformation may boost patient outcomes, operational effectiveness, access to healthcare services, and ultimately support the hospital's objective to provide patients with high-quality treatment.

4. Instrumentation

6.1. Tool

Patient Questions

1. Are you a new patient or a follow-up patient?
   a. New Patient
   b. Follow – Up Patient

2. How long did the registration take?
   a. 0-30 mins
   b. 31 min-1 hour
   c. 1 hour-2 hour
   d. More than 2 hours

3. What is the waiting time for OPD?
   a. 0-30 mins
   b. 31 min-1 hour
   c. 1 hour-2 hour
   d. More than 2 hours

4. How have you taken Appointment?
   a. Online Website
   b. Walk in

5. Was there any queue for reaching the Doctor?
   a. Yes
   b. No

6. How long did the doctor spend time consulting with you?
   a. 5-15 min
   b. 15-30 min
   c. 30-45 min
   d. >45 min

7. How did you get your lab reports?
   a. On phone
   b. On counter

8. What's you payment mode?
   a. QR Code
   b. Case

c. Online Payment

9. How long you were required to stand in Queue for paying for Tests
   a. 5-15 min
   b. 15-30 min
   c. 30-45 min
   d. >45 min

10. How Satisfied are you? – 1- Strongly Dissatisfied 5 – Extremely Satisfied
    a. OPD Registration
    b. Billing
    c. Investigation
    d. Waiting time

11. Any other comments / feedback

Faculty Questions

1. Name _____ Ph No: _____ (optional)

2. How long you have been in AIIMS
   a. 0-5 yrs
   b. 5 – 10 Yrs
   c. 10- 20 yrs
   d. 20 and more Yrs

3. How much time (in %) do you spend on?
   Scale: 10% 20% 30% 40%
   Patient Care
   Research
   Teaching
   Administrative Work

4. How many eHospital module are you aware of?
   a. 1 – 3
   b. 4- 6
   c. 7-10
   d. 11 and above

5. How many other applications are you aware of:
   a. 1 – 3
   b. 4- 6
   c. 7-10

d. 11 and above

6. Would you like to receive alerts for pending tasks?
   a. Yes
   b. No

1. Would you like phone access to tasks related to patients, administration, academic and research?
   a. Yes
   b. No

2. Can you easily access patient records?
   No - - - - - - -Slider---------- Yes

3. What features would u need in the HMIS?
   a. Ability to manage patient care schedule.
   b. Teleconsultation
   c. Access to patient's medical records

4. Any other feedback

Nursing

1. Name _____(optional)

2. How long have you been working for AIIMS?
   a. 0-5 years
   b. 5-10 years
   c. 10-15 years
   d. 15+ years

3. How much of your time(in %) goes into Clinical work Administrative Work?
   a. Clinical work
   b. Record Maintenance

4. How many eHospital module are you aware of :
   a. 1 – 3
   b. 4- 6
   c. 7-10

d. 11 and above

5. How easy is to access the modules in eHospital?
   1 – very difficult, 5 – very easy

6. Do you have adequate IT Infrastructure?
   a. Yes
   b. No

7. What would you like in the HIS?
   a. Patient discharge tracking process
   b. Complaint management/redressal system
   c. Notification for lab reports for patient based on urgency
   d. Tracking of deployed hospital attendant

8. Any other feedback

6.2. Consent Form

Consent for Feedback survey for tertiary care hospital

Digital Transformation of a Tertiary Care Hospital

Informed Consent

You are invited to participate in a research study about Digitalization of a tertiary care hospital. The goal of this research study is to find out the requirement and need for the tertiary care hospital to undergo digital transformation.

This study is being conducted by consultants hired by the hospital to help with the digital transformation.

Participation in this study is voluntary.

Participating in this study will help us learn the gaps of the current process. You may skip any questions you don't want to answer.

The information you will share with us if you participate in this study will be kept completely confidential and anonymous.

Please note: You must be a patient or be currently employed by the Hospital

By completing this survey, you are consenting to participate in this study.

(Participant Signature)

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