

ASSESSMENT OF ELECTRONIC HEALTH RECORDS PLATFORM IN HOSPITAL SETTING

Dissertation Submitted to



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(MBA)

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by

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Under the Supervision and Guidance of

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Dissertation completion certificate:

Internship Completion Letter

Internship Completion Letter

Date : 1st March to 19th July, 2022

Subject : Completion of Internship Letter

To Whomsoever It May Concern,

M16labs certifies that Dr. Palak Mahajan successfully completed the internship program at our organization as a Project Management Intern.

During this time, Dr. Palak worked on the development of key health Information Technology projects.

By working on these projects, Dr. Palak acquired critical Project Management skills.

Dr. Palak displayed professional traits during her internship period and managed to complete all assigned tasks as requested. She was hardworking, dedicated, and committed. It was a pleasure having her with us in this period.


Yours sincerely,
Anil JJ

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CONTENTS:

INTRODUCTION:

Project managers are continuously working hard to enhance and advance their processes to enhance patient care, reduce costs, and improve the patient's overall experience and fulfilment.

Healthcare project administration skills became progressively vital to businesses, comprising the healthcare industry, because they support control costs, dealing risk, and refining project outcomes. By relating project management techniques, organizations can thoroughly plan, organize, and accomplish a set of responsibilities amplifying resources and accomplishing specific goals.

An establishment must be enthusiastic to change and uninterruptedly progress its keenness in all functions to achieve long-term success. This is especially true because user perceptions of quality are constantly changing. Organizations are attempting to advance the worth of their products and services by executing projects such as unceasing process upgrading, total quality administration, total efficiency management, and so on. The success of these efforts is heavily reliant on project management principles and techniques. The paper outlines the values, strategies, and practises for executing nonstop quality enhancement in project management. Some of the common roadblocks to executing quality improvement are also discussed.

Healthcare project management can be powerful as the risks are higher. Like other organizations, hospitals that practice active project management will benefit from lower costs and enhanced outcomes. Because the hospital and the patients will always benefit, it is well worth the time and effort to ensure that it is done correctly.

Project managers specialize in making operations simpler and more efficient. They oversee projects that are essential to business strategy, ensuring they're done on time and within budget.

That's appealing in the healthcare industry. While growing rapidly, healthcare is also longing for a period marked by drastic change and technological innovation, creating the necessity for process improvement.

Various types of electronic records have been investigated, analysed, designed, or implemented over the last 20 years, with enormous breakthroughs in information technology, notably in the domains of health. EHRs are described as digitally stored medical records that are preserved for the entirety of a person's life in order to support care continuity, education, and research. EHRs may contain information on observations, lab results, medical imaging,

therapies, treatments, drugs given, patient identification data, legal permissions, and other things.

Implementing EHRs in a healthcare system is more complicated than it first looks. When it comes to implementing an electronic health records system, there are several potential roadblocks. Providers can avoid problems and improve the efficiency of the transfer process by being aware of them in advance.

The gathering, maintenance, and use of electronic healthcare records are frequently the focus of health IT and health informatics projects. These records are critical both monetarily (in terms of Medicare payments, for example) and in terms of improving patient outcomes by making them available to healthcare practitioners on a constant basis.

RESEARCH QUESTION:

What are the benefits of EHR (MetahOS) platform in a hospital setting?

OBJECTIVES:

1. To review various electronic health records platforms including MetahOS and document their enabling and hindering factors
2. To study MetahOS processes in a hospital setting
3. To assess enabling factors and barriers encountered by MetahOS during EHR implementation in the hospital setting.

LITERATURE REVIEW:

“Barriers to implement Electronic Health Records (EHRs)”: Sima Ajami and Razieh Arab-Chadegani May (2013)., <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3804410/>. The goal of this study was to identify the most significant obstacles to using EHRs. This research was a non-systematic review. The literature on the primary impediments to implementing EHRs was combed through using the library, books, conference proceedings, data bank, and search engines such as Google Scholar. More than 43 publications and reports were collected for this study, with 32 of them being chosen for their relevance. Many studies show that resistance to change is more relevant than other difficulties in implementing the EHR. In spite of the possible paybacks of electronic health records, their implementation aspects face several challenges and limitations, the greatest are cost restrictions, technical limits, attitudinal restrictions-individual behavior, and structural limitations. Reluctance to change is a more relevant barrier than other difficulties in implementing the EHR.

“Barriers for Adopting Electronic Health Records (EHRs) by Physicians”: Sima Ajami and Tayyeb Bagheri-Tadi. June (2013)., <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3766548/>. The review of publications reveals a wide range of potential impediments to EHR implementation. Despite the good impacts of employing EMRs in medical offices, their adoption rate is still low, and physicians are resistant using them. Use of an electronic health record requires a certain user profile, a certain system profile, external assistance, and a number of organisational and environmental enablers. EHR systems must be used effectively by clinicians after they are made available to have a beneficial influence on patient safety. It should be able to improve physicians' capacity to treat patients by taking into account the factors found in this study. Many medical schools do not use EHRs or provide training on how to use them. Teaching medical students to rely on EHRs and related decision assistance features will only hasten EHR adoption. This study's outcomes can be utilised to provide an overview of potential challenges that physicians may encounter during the EMR deployment process.

“Electronic Health Records: How Close? How Far to Go?": Lisa Sprague, George Washington University. September (2004)., https://hsrc.himmelfarb.gwu.edu/cgi/viewcontent.cgi?article=1139&context=sphhs_centers_nhpf. Health IT planners are buzzing with excitement and enthusiasm. Almost everyday, there are reports of new evidence or optimism regarding the influence of EHRs on quality. Researchers from the Agency for Healthcare Research and Quality, for example, gave tracking/reminder systems an A for its ability to improve the quality of care for racial and ethnic minorities. 39 Patients in cardiology and internal medicine at the Nebraska Medical Center can now get free, updatable CDs of their medical records. Still, there's a sense of preaching to the choir in all of this. Those that are enthusiastic about technology make every effort to adopt it. Those who are unconvinced or even opposed, such as an American Medical News contributor who highlighted interference, intrusiveness, and poor performance as EHR downsides, have remained unaffected thus far. 41 Many observers hope, or even presume, that as a business case emerges and practice standards shift, resistance will convert, but the tide has not yet turned. As previously stated, the grounds for physician opposition to EHRs may be just as compelling as those in support of them. Objections to the idea that a physician should invest in IT to reduce his or her own pay by saving money for someone else are particularly difficult to overcome. Aligning financial incentives to promote quality remains a policy challenge—and, many would say, an absolute necessity. The federal government's leadership also appears to be crucial It's impossible to conceive spontaneous harmony in a nascent health information system with so many moving pieces. Consensus is desirable but pursuing it might cause delays if done incorrectly. There will be no stalemate. In the end, as in the beginning, the evaluation of EHRs is based on their contribution to patient care. the goal of providing everyone with safer, higher-quality, and more efficient care.

“Factors affecting the acceptance of integrated electronic personal health records in Saudi Arabia: The impact of e-health literacy”: Yaser A Alsahafi, Valerie Gay, Adel A Khwaji. November (2020)., <https://journals.sagepub.com/doi/abs/10.1177/1833358320964899> . Because this type of technology guarantees to expand and improve healthcare, national adoption of electronic personal health record (ePHR) systems is crucial for governments everywhere. Although the benefits of ePHRs are generally acknowledged, there hasn't been much awareness or adoption of this technology among patients. The purpose of this study was to pinpoint the elements that may affect how well an integrated ePHR system is received and put to use in Saudi Arabia. In this research, e-health literacy (e-HL) was tested using structural equation modelling. 794 valid replies to the questionnaire survey that was used to gather the data were received. The countrywide rollout of an integrated ePHR system in Saudi Arabia was revealed to have a low degree of knowledge among Saudi residents. This suggests the necessity to create a greater and more broad understanding of the system and to illustrate its utility.

By highlighting crucial variables that may affect the adoption and usage of integrated ePHRs, the study's findings can help governments, legislators, and developers of health information technology and systems.

“Electronic Medical Records implementation in hospital”: Anna De Benedictis, Emanuele Lettieri, Luca Gastaldi, Cristina Masella. June (2020)., <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0234108>. Many hospital management still have unanswered questions about how to adopt Electronic Medical Records (EMRs) across the whole facility. EMRs have extended been recognised as essential to improving healthcare quality and safety, saving costs, reducing patient adverse events, simplifying processes, advancing clinical research, and getting the best clinical results. Professional opposition to accepting EMRs remains a problem for hospitals. This study integrates personal and institutional components to describe what variables managers may use to affect the behaviour of professionals and what factors might support or impede the usage of electronic medical records in hospitals. A survey given to doctors and nurses at an Italian university hospital in Rome has been used to gather data. The results of the analysis show that normative factors and individual factors are the main factors influencing people's intentions to use electronic medical records. A mediator between normative characteristics and intentions to utilise EMRs is perceived usefulness. Hence, organisation can employ influential people to inspire change and manage it.

“Effects of Electronic Health Record Implementation and Barriers to Adoption and Use”: Chen Hsi Tsai, Aboozar Eghdam, Nadia Davoody, Graham Wright. December (2020)., <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7761950/>. Despite the significant advancements in the area of electronic health records (EHRs) throughout the past 25 years, acceptance and implementation issues still exist, and the advantages achieved are still not up to par. The objective of this scoping review was to give the most recent information on

the consequences of EHR deployment and the obstacles to EHR adoption and use. A total of 7641 studies were found, of which 142 satisfied the requirements and received unanimous approval from all researchers for inclusion. The outcomes of EHR deployments and continued hurdles to EHR adoption and use were the subject of this literature review, which produced contradictory results. While some of the negative effects, such as an increase in workload and dysfunctional workflows, seemed to remain consistent over time, there did seem to be an increase in the good benefits. This review did not adequately analyse the included publications, and there was also a lack of consistency in the definitions of EHRs used, as well as a lack of comprehensive contextual information about the study settings. In order for others to compare the findings of various evaluation studies, researchers must adhere to the rules for reporting evaluation studies. Additionally, this would make it possible to measure the outcomes of the adoption of EHR systems and eHealth services more thoroughly.

“Impact of Electronic Health Record Interoperability on Telehealth Service Outcomes”:Xinyue Zhang ; Richard Saltman. January (2022)., <https://medinform.jmir.org/2022/1/e31837/> . This study looks at three essential elements in order to ensure efficient telehealth service delivery, reduce professional tiredness, and enhance access to treatment: Quality of telehealth services, electronic health record systems, and health information are listed in that order. Using a policy analysis technique, the article evaluated telehealth applications in rural health, mental health, and veterans health care. The findings showed that while benefit-based and group-based care are made possible by telehealth and semantic/organizational interoperability, there are still difficulties in improving user satisfaction and experience (for both patients and physicians). The finding suggests that strategies at the systemic and general practitioner levels are required to lessen differences in the acceptance of health expertise and enhance approach to telehealth care.

MATERIAL AND METHODS:

STUDY DESIGN: Descriptive Study

STUDY SETTING: The study was conducted in Two Hospitals: ABC and XYZ. ABC Hospital is a 27 Multispeciality Bedded Hospital in Hubli District of Karnataka and XYZ Hospital is a 250 Bedded Multispeciality Hospital in Kondapur District, Western part of Hyderabad, Telangana, India.

STUDY POPULATION:

1. Front Desk Staff
2. Data Entry Operators
3. Nurse
4. Pharmacist

5. IT Admin professionals
6. Doctor Secretaries
7. Doctors
8. Medical Superintendent
9. Billing Agents

SAMPLING AND SAMPLE SIZE

Intern could interview 10 front desk operators from each hospital based on their morning and evening shift, 5 data entry operators from each hospital based on their morning and evening shift, 6 Nurses from each hospital based on their morning and evening shift, 6 Pharmacist from each hospital based on their morning and evening shift, 10 IT Admin professionals from each hospital who heads digital patient experience units in each Hospital, 5 HOD and 10 Doctors from each hospital based on availability during Morning time and afternoon time and 5 Billing agents from each Hospital who look after Billing procedures and IRMS (Insurance and Risk Management Services) unit in Hospital.

Table 1: Sample size by category of hospital staff

Category of Hospital Staff	Morning shift	Evening shift	Total
Front Desk Staff	10	10	20
Data Entry Operators	5	5	10
Nursing staff	6	6	12
Pharmacists	6	6	12
IT Admin professionals	10	10	20
Doctors' (HOD)	5	5	10
Doctors including HODs	10	10	20
Medical Superintendent	1	1	2
Billing Agents	5	5	10
Total			116

DATA COLLECTION METHODS AND STUDY TOOLS:

- Review of Literature- Google scholar and PubMed
- Interviews- Pen-Paper and audio recorder.
- Observation- Direct Observation
- Documents and records- Hospital Care records and record review
- Oral Histories- Pen-Paper and audio recorder.

- Focus group discussion- Guide

DURATION OF STUDY:

Two months (25th April-4th June)

Data collection was done in 10 days period

10 Days (25th April-4th June)

DATA COLLECTION PROCEDURE:

The intern- collected data through direct observations, interviews, Documents & record reviews, and verbal reporting.

(25th April to 27th April): The intern assessed existing gaps and difficulties end-users face in a hospital setting by using legacy software. During this intern collected data by Direct observations and reviewing records. Focus group discussion carried out during this period.

(28th April to 29th April): Created solutions by MetahOS by developing requirements and features that will address difficulties faced by end-users. During this intern collected data by direct observations and interviews. History of workflow and processes reviewed.

(30th April to 1st June): Developed Customizations as per requirements and created Workflows for a hospital setting.

(2nd June to 3rd June): Hands-On Training of end users on MetahOS software and addressing real-time questions.

DATA ANALYSIS:

After collecting data, the intern created reports, assessment sheets, and e-workbooks to comprehend the data in one place. Then used Excel to analyze the required data.

OPERATIONAL DEFINITIONS:

HIS (Health Information System): A health information system (HIS) is a system for managing patient data. Systems that support healthcare policy choices, a hospital's operational administration, or systems that collect, store, maintain, and transmit a patient's electronic medical record (EMR) are all instances of this.

CRM (Customer Relations Systems): is a piece of technology that enables you to keep track of every customer and potential customer interaction for your business. Improving commercial ties is the clear goal. Hospitals benefit from a customer relationship management system (CRM) by keeping in touch with patients, simplifying procedures, and boosting revenue.

LIS (Laboratory Information System): is a patient data processing, storage, and management software solution for laboratory processes and testing. The workflow and

quality control of inpatient and outpatient medical tests, including those in the fields of haematology, chemistry, immunology, microbiology, toxicology, public health, and other lab fields, are organised by providers and laboratory professionals using laboratory information systems. Laboratory information systems keep track of, retain, and update clinical information about a patient during a physician visit in their database for future use.

RIS (Radiology Information System): is a networked software system for managing and storing images and data related to medicine. A RIS is widely used in combination with PACS and VNAs to manage image archives, record-keeping, and billing. A RIS is particularly useful for preserving radiological imaging requests and billing data.

QMS (Queue Management System): A queue management system is a collection of tools and sub-systems that help control customer flow, manage waiting times, and improve customer experience.

ETHICAL CONSIDERATIONS:

The following points were considered during the study

- Informed consent- All and the respondents were informed about the assessment to be carried out and consent form was shared
- Voluntary participation- there was voluntary participation by the staff of the hospital.
- Confidentiality of the hospital maintained. Neither the name of the hospital nor employee's identity was disclosed in this study.
- Anonymity was maintained in data analysis

RESULTS AND DISCUSSIONS:

1. MetahOS processes in a hospital setting:

The processes were assessed in the departments like Call center, CRM (Customer relation Systems), OPD Front office systems, eHealth and IPD systems.

STEP 1: In an hospital setting, process starts with assessment of existing workflows and processes followed in an hospital.

STEP 2: Assessment of Gaps in existing softwares.

STEP 3: Noting all the requirements needed by end-user and hospital administration.

STEP 4: Presenting MetahOS enabling solutions to gaps and working on customizations as required by a hospital.

STEP 5: Training end users and trainers.

STEP 6: Implement a complete Digital Patient Experience.

STEP 7: Digital Patient Experience includes

- Online Bookings
- Walk-ins Patient Self Service Portal
- Check-ins to Digital Prescriptions
- Lab Orders & Reports
- Radiology Orders & Report
- Seamless Integration for Patient Registration
- Scheduling of Appointments
- Payments and Digital OPD Workflows
- Create a Central Repository of Patient Records using Enterprise Master Patient Index (EMPI).

The aspects of the MetahOS process in hospital Setting involves making information more accessible, health information be digitized and even patient locations within a provider facility are being mapped. Focusing on the patient experience and their communications with the hospital is another important factor. This might involve using a follow-up system that automatically queries patients about their experiences with care after they have left the hospital or keeps them updated on their medical problems and ongoing care.

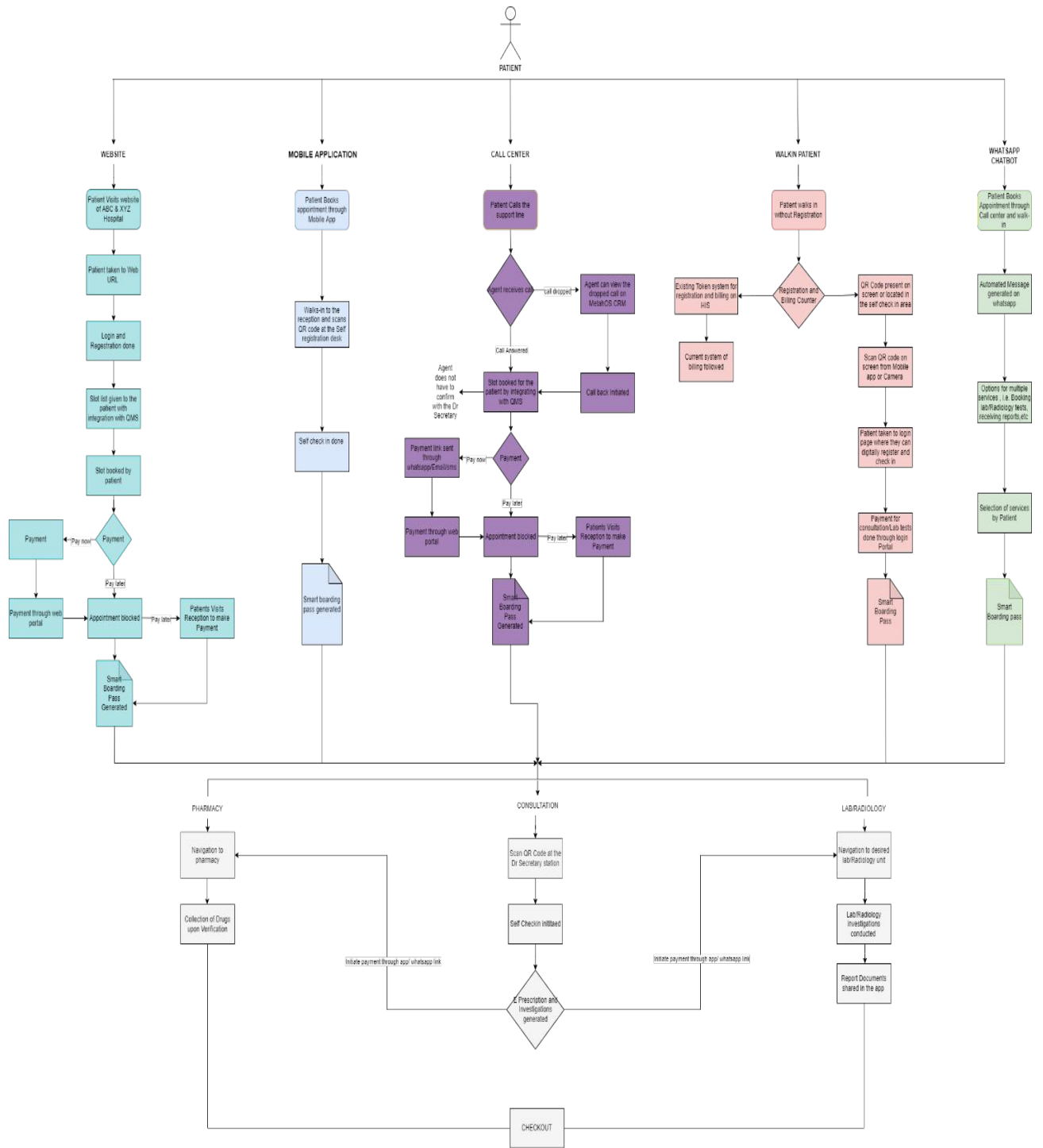


Fig 1.: MetahOS workflow in an hospital

MetahOS processes Using Website

The websites vary for each hospital. Its URL is <Hospital name>.metahos.com. If a hospital decides to use MetahOS, they can create their own website.

With MetahOS, patients will be able to

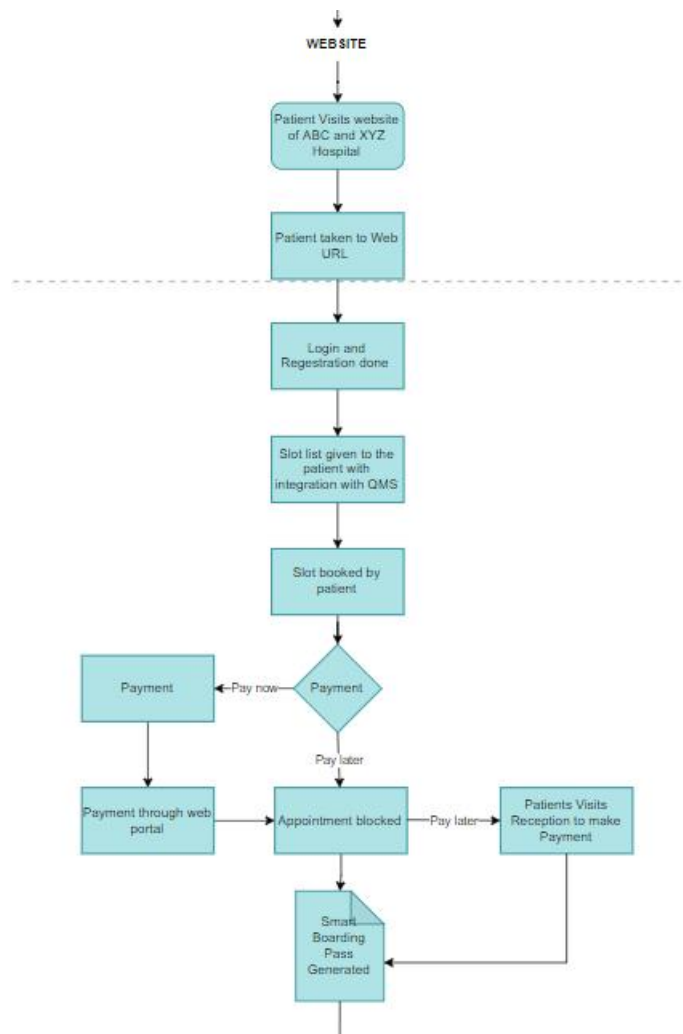
- Book Lab Tests
- Book medications
- Book radiology tests
- Order Medications

Patients will also be able to:

- Manage their personal health record
- Manage their family health
- Consult Online
- Make Online Payments

ADVANTAGE:

- By Booking appointments online, it is easier to manage information. From the website bookings will be populated in the MetahOS as a lead.



Aspects	Current Hospital Scenario	Future Hospital Scenario
People's perspective	Website option for booking appointments in ABC hospital is limited	Website options for booking will result in automated alerts and notifications, listing of patients in leads, and capturing demographic information in medical records.
Process perspective	Dependence on manual processes for navigation and appointment	Reduce manual processes by automating standard operating workflows on the website and by providing patients with self-instructional guidance for the next steps in the care journey.

MetahOS processes Using Mobile Application:

Mobile application, unique for each hospital, is powered by MetahOS on the name of Hospital.

Using the MetahOS mobile application, patients will be

- Book Lab Tests
- Book medications
- Book radiology tests
- Order Medications

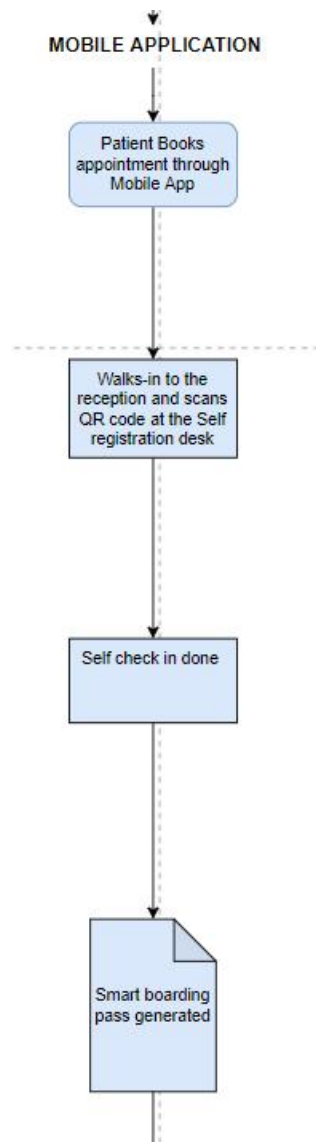
All the information from the website will be populated in the MetahOS platform.

Additionally, Patients will also be able to:

- Manage their personal health record
- Manage their family health
- Obtain access to health education
- Consult Online
- Make Online Payments

ADVANTAGE

- Staying connected with the patient
- Information therapy
- Ease of booking appointments



Aspects	Current Hospital Scenario	Future Hospital Scenario
People's perspective	Counsellors, call-centre front office staff, doctors' dependent processes	Reduced workload on Counselors, call-center front office staff, doctors dependent processes due to METAHOS Mobile Application for staying connected, information therapy and ease of booking appointments
Process perspective	Broken flows for each department with little possibility of digital interaction with patient	Streamlined workflow with seamless information sharing from department to department

Technology perspective	Use of systems that are not integrated	Systems that will talk to each other
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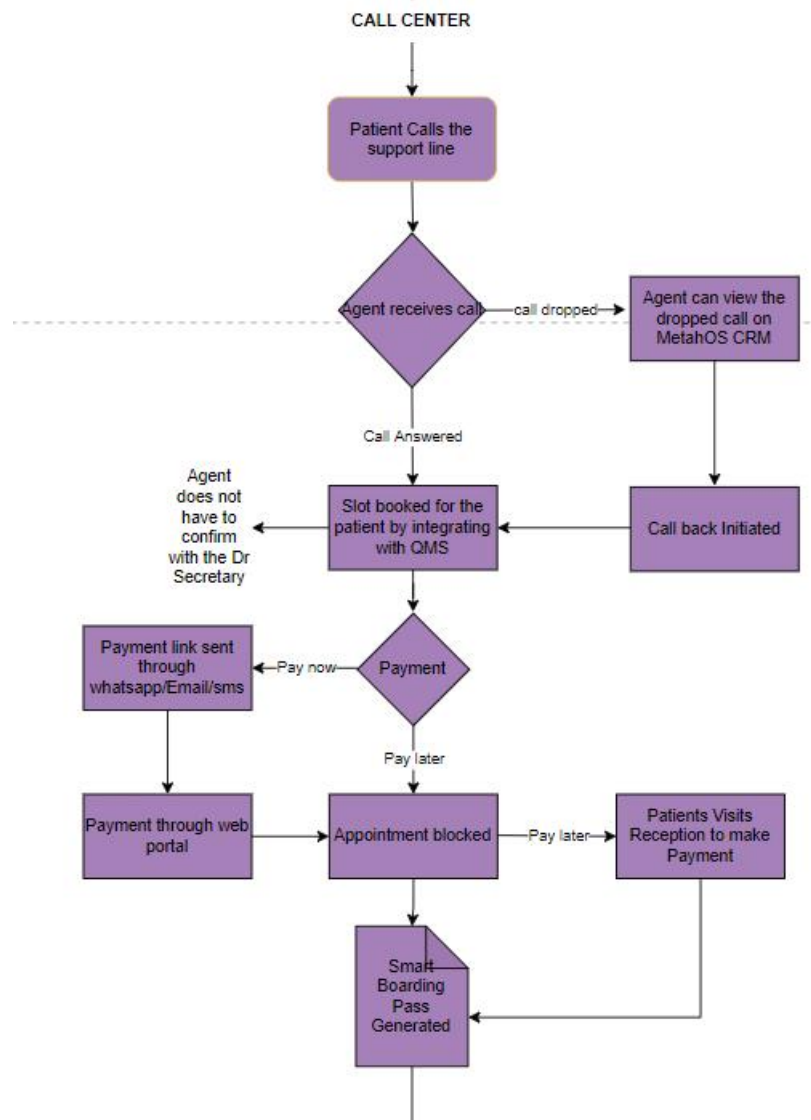
MetahOS processes in Call Center

Enhancing the ability of the current call centre, MetahOS will integrate with the

- WhatsApp and SMS-based alerts and reminders for patients.
- Call back initiated for dropped calls
- Queue Management System to be replicated to show slot availability for consultants
- Payment options for the patients to block appointments

ADVANTAGE

- Reduce No show rates
- Administration can track and monitor the quality of service



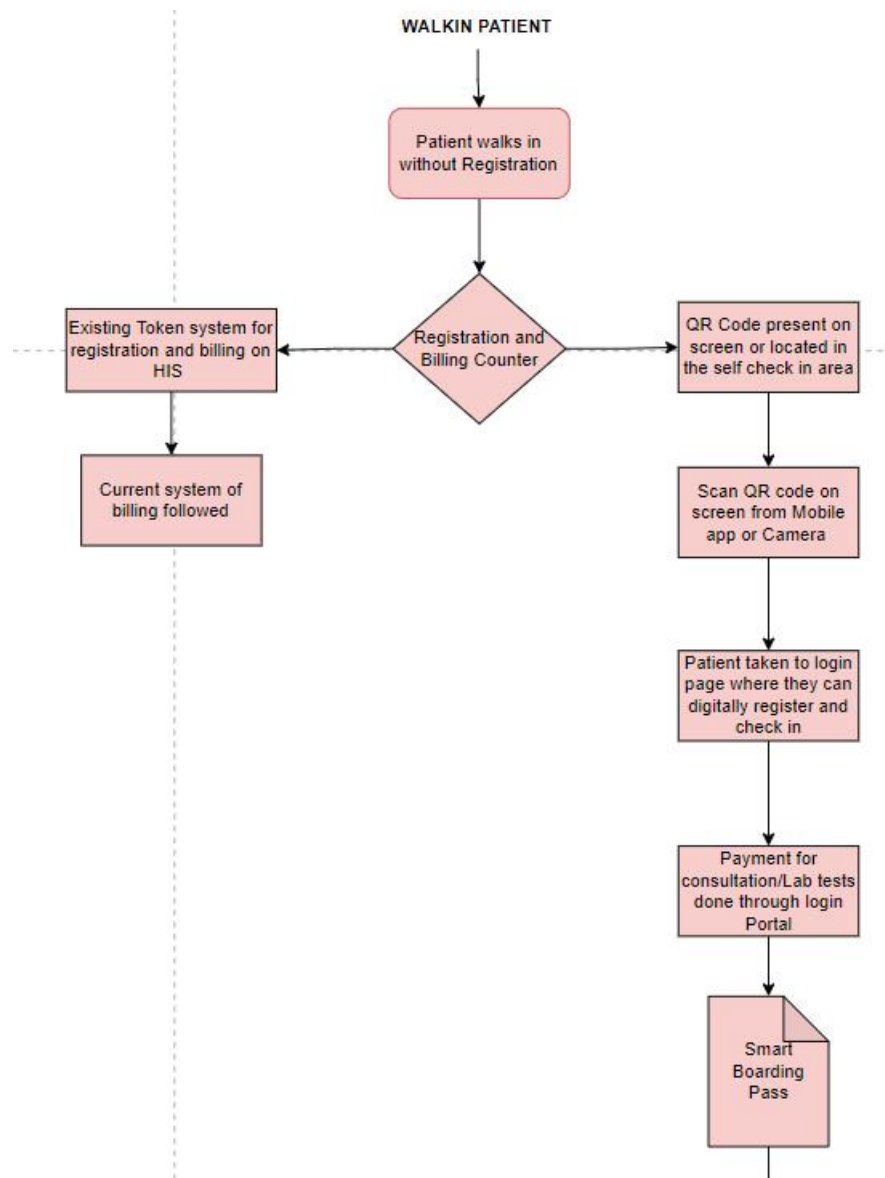
Aspects	Current Hospital Scenario	Future Hospital Scenario
People's perspective	Labor intensive: scheduling appointments from calls, double entry of data.	Seamless scheduling of appointments from calls received. No duplication of efforts.
Process perspective	Process for answering calls and booking appointments existing in a silo. Monitoring and receiving calls independent from HIS processes.	Streamlined process for scheduling appointments for receiving calls, sharing of the same information across different departments
Technology perspective	CRM and HIS operating in Silos	Integrated flow from CRM to MetahOS to HIS

MetahOS processes for walk in patients:

- For Walkin Patients MetahOS proposes have self-check-in counters.
- The Self-check in counter will have a QR Code print from which the patient can directly scan.
- This will take them to the official Patient portal where they can register
- Self-check-in QR codes will be available on each floor on the secretary counters
- Each floor will have its own self-check-in QR code to avoid miscues.

ADVANTAGES

- Reduce load on the front office
- Reduce Patient waiting time
- Decrease Turnaround Time for OPD



Aspects	Current Hospital Scenario	Future Hospital Scenario
People's perspective	Heavy workload on the front office staff	Reduced workload with MetahOS Patient Booking Kiosk
Process perspective	Entering of Data on HIS	Booking and Registration data seamlessly on MetahOS
Technology perspective	Independent Channels for registration	MetahOS' multiple channels of registration and booking seamlessly.

MetahOS processes Using WhatsApp Chatbot:

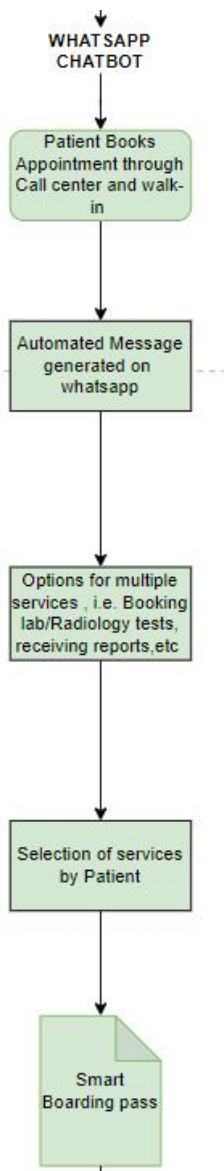
Our new age chatbots are capable of delivering personalized care to patients

Use Cases include

- Booking Appointments
- Booking lab tests
- Booking Radiology tests
- Managing reports by patient
- Ordering Medicines
- Making payments

Advantages

- Instantaneous information on the patients' fingertips
- Prompts at each step of the treatment journey
- Easy tracking of the patient journey



Aspects	Current Hospital Scenario	Future Hospital Scenario
People's perspectives	WhatsApp chatbot not available for making appointments	Availability of WhatsApp multi-functionality WhatsApp chatbot for registration, service booking and information therapy
Process perspectives	Human involvement in the conversation	Automated responses for FAQs and common functions, human involvement in more complex operations
Technology perspectives	Technology not available	Technology would be available and would share data across all departments.

MetahOS provides following modules in an Hospital Setting:

Modules	Description	Role in Future State
Patient Relationship Management	Helps care providers communicate with their patients more effectively, automates patient-centric workflows, reduces administrative costs, and increases patient satisfaction.	• Scale growth effectively • Improve patient satisfaction • Increase patient engagement • Provide quality care
OmniChannel 24X7 Call Center, Intercom	Provides services like giving information to consumers, responding to their queries, and scheduling appointments	• Effective patient care and increases patient satisfaction • Bridging the gap between front and back office • Proactive engagement and notifications
Digital OPD, NDHM Ready*	Streamlines clinical data acquisition in patient's care pathway	• Keeping track of the patient journey • Coordinating across different care segments
Marketing, Sales & Referral Management	Helps organizations to achieve their sale objectives or, ideally exceed them	• Better engagement and stronger relationships • Increased revenue • Better quality leads • Understanding consumer needs • Improves company culture

SERVICES PROVIDED BY METAHOS:

1. Patient Registration & Billing
2. Doctor Appointments Scheduling
3. Pharmacy Information System
4. Analytical
5. Dashboard
6. Practice Management System
7. Revenue Management System
8. Patient Relationship Management
9. Clinical Management System

10. Multi-language support
11. Purchase & Inventory Management etc.

Enabling factors and barriers encountered by MetahOS during EHR implementation in a hospital setting.

Smart organizations are putting the patients first. By using their data, they can deliver relevant and targeted content that adds value to the patient experience. And without EHR software, hospital staff as well as patients may find it difficult.

- People: High workload on the staff, and challenges in employee retention.
- Process: Limited communication channels with the patient, and usage of systems that do not talk to each other result in convoluted processes.
- Technology: Usage of legacy systems creates issues in creating a complete digital experience. Lack of Systems Integration across all the systems & applications that are used at the hospital.
- Environment: Increase in patient demand for technology, instant information, and staying connected with their care provider.

Many Hospitals continue to use and maintain legacy software, despite costly and creative digital transformation efforts. That's because, over time, such systems have become critical to the organization's operations, and replacing them with more current alternatives isn't always easy.

In a Hospital, a legacy system is an obsolete computer system, software solution, or other technology that is difficult to operate. However, legacy systems might be essential to an organization's workflow procedures. A legacy system, sometimes referred to as a legacy platform or legacy technology, is a computer system that has been around for a long time.

When data sets and other information are not fully used by new cloud platforms, legacy systems can be a barrier to effective operations.

Nonetheless, many businesses must modernise outdated systems in order to improve network security, enable the addition of new software capabilities, and increase productivity.

Here are some of the barriers that legacy software presents, as well as the reasons why systems must be replaced:

1. A higher security risk

In the first place, outdated systems usually provide a serious security concern. This is because they are always out of date and, in some circumstances, no longer get maintenance from the manufacturer or distributor.

2. Ineffective and unreliable

Not only are legacy systems insecure, but they are also ineffective. They aren't always conducive to raising employee productivity, to put it another way. This is because they were developed and put into use at a period when company procedures and practises were out of date.

3. Incompatible with cutting-edge technology

Many legacy systems are stand-alone because they were never designed to interact with other types of software. While this would have been acceptable in the past, it currently drastically restricts the flexibility, scalability, and interconnections that can be carried out by any Hospital.

4. There is only one point of failure

What happens if an hospital have a legacy system that is critical for their business operation, and only one or two of their users know how to use it – and only a few of their IT team know how to support it?

Furthermore, wouldn't it be a better use of IT resources' time to concentrate on the more current systems that are introduced rather than spending their days trying to keep legacy software running?

5. Information deficiency

That's because it was developed at a period when capturing and processing massive data wasn't necessarily common practise.

Table 1. Barriers encountered by end-users and solutions provided by MetahOS

STUDY POPULATION	ROLES/RESPONSIBILITIES	BARRIERS ENCOUNTERED	SOLUTIONS BY METAHOS
Front Desk Staff	• Billing and registration • Booking consultation • Managing OPD worklist.	• Increase workload • Standalone legacy software • Software don't talk to each other • Data not accessible in one place • Multiple softwares for different modules	• Complete Integration from patient registration to discharge on a single platform • Decrease workload • Data is saved on the cloud storage. • Patient data can be accessed on single platform • All modules available in a single software • End to End integration
Doctor Secretaries (DS)	• Managing QMS (Queue Management system) • Booking appointment • Managing Doctors consultations	• Poor Queue management • Increase TAT • Poor patient satisfaction • No Patient digital experience	• DS can manage doctors' calendar • Can send payment links directly saves time for patients • TAT

Table 2. Barriers encountered by MetahOS during implementation and enabling solutions MetahOS provides to Stakeholders to overcome barriers Department wise in Hospital Setting:

Departments	Barriers Encountered by MetahOS (Gaps identified)	Enabling Solutions by MetahOS
Blood Bank	The name, age, gender does not get auto edited at the blood center when the data is changed at the registration counter • On entry of some IP numbers in front desk, it sometimes shows blank page • Incompatibility report change Adm/CR no.- IP number • If a blood unit is verified as biohazard and when someone adds this unit of blood by error to any patient in cross-matching section automatically alert notification that this sample is biohazard should appear • In the cross-matching section if someone changes blood group (error) they have to mandatory fill the remarks column before changing the blood group. • Viewing of blood grouping reports in the various areas of the hospital without	• MetahOS to maintain UHIDs across different softwares through an Enterprise Master Patient Index. Seamless flow maintained from the registration counter itself with UHID. • Website options for booking will result in automated alerts and notifications, listing of patients in leads, and capturing demographic information in medical records. • Reduce manual processes by automating standard operating workflows on the website and by providing patients with self-instructional guidance for next steps in their care journey.

	any edit option • SMS appreciating the blood donors after blood donation • Pop up of names of blood donors after three months of blood donation in males and four months in females and reminders to donors that they are due for donations • Interfacing with the store regarding the stock position of kits, reagents, and blood bags. • Interfacing of ELISA system / cell counter / grouping and crossmatching system with the Blood Centre software.	
MRD (Medical Records Department)	• In patient number is created manually here • Need of integrated document management system • Dashboard off daily discharge and admissions of patients • Most of the work is manually done here. • No integration with HIS	• MetahOS can generate the UHID and maintain it across all the departments. Additionally, the document management system contains all structured and unstructured data. The document can be uploaded on the basis of the Report Type and Date of Report. • HIS integration in which patient data is available from registration to discharge
NUCLEAR MEDICINE	• No daily reports • Needs to be integrated with HIS • Most of the work is	MetahOS Analytics Engine can provide reports and dashboards using the Daily, Weekly,

	manual here • Reporting formats should be incorporated within the system (right now manual)	Quarterly and Monthly filters. Formats for existing reports can be templated for ready publication.
Imaging suite	• No unique ID details • Retrieving of the data not possible • Need cloud so that can be saved and viewed by others • No daily reports • Needs to be integrated with HIS • Most of the work is manual here • Patient details should be accessed but at the same time provision should be there to upload details for each patient • Billing to be integrated within HIS	MetahOS can generate the UHID and maintain it across all the departments. Additionally, the document management system contains all structured and unstructured data. The document can be uploaded on the basis of the Report Type and Date of Report. The Document Management System is completely cloud-based. The existing Radiology information System tool or the MetahOS Radiology Information System tool can be used for Imaging. The patient details will be available here across all departments.
Nutrition Department	• Needs to be integrated with HIS • Most of the work is manual here • Reporting formats should be incorporated within the system (right now manual) • Assessments taken manually. Needs system for checklist and assessment filled from patients respectively.	Nutrition assessments can be digitized for a completely digital care experience.

OPD REGISTRATION COUNTER:	• Outpatient registration and new visit registration. No modifications can be made except date and time when registering as a new visit registration. • More additions and modifications needed in the form • Form should be pre-printed with all the fields. • No statistical analysis possible. • Barcodes with unique id for each patient • Forms should have barcode scanning option and unique barcodes and patient id for each patient should be there • Online registration and online payment options are not available here (online registration is available in the new OPD block but queue management is not there). • Shift record is available, but no day wise record is available (like total number of patients, different ages of the patients) . Day wise dashboard should be there with each detail summing up all the features.	• Reduce manual processes by automating standard operating workflows on the website and by providing patients with self instructional guidance for next steps in care journey • Website options for booking will result in automated alerts and notifications, listing of patients in leads, and capturing demographic information in medical records. • Streamlined workflow with seamless information sharing from department to department • MetahOS multiple channels of registration and booking seamlessly interfaced with HIS • Availability of WhatsApp multi-functionality WhatsApp chatbot for registration, service booking and information therapy • Automated responses for FAQs and common functions, human involvement in more complex operations Technology would be available and would share data across all departments.

NEW OPD BLOCK:	• Same system to be implemented in this block with all the modifications and features • Queue Management (Proposed that during registration they should be equally divided in different units and the same unit's name should be reflected in form)	• Reduce manual processes by automating standard operating workflows on the website and by providing patients with self instructional guidance for next steps in care journey • Website options for booking will result in automated alerts and notifications, listing of patients in leads, and capturing demographic information in medical records. • Streamlined workflow with seamless information sharing from department to department • MetahOS' multiple channels of registration and booking seamlessly interfaced with HIS • Availability of WhatsApp multi-functionality WhatsApp chatbot for registration, service booking and information therapy • Automated responses for FAQs and common functions, human involvement in more complex operations Technology would be available and would share data across all departments.
ADMISSION COUNTER:	IP number not generated here (in MRD department it is generated) • Not integrated with HIS • Barcodes are manually generated	Streamlined workflow with seamless information sharing from department to department • Reduced workload with MetahOS Patient Booking Kiosk. • Separate login ids for

	• Most of the work manual here • No full patient details can be seen • Same patient after OPD gets different IP number • Modifications and updating of fields required • No statistical reports there (how many patients got admitted etc.) • Dashboards along with check reports required	employees. • Statistical view will be available-daily, weekly and monthly. • Barcode scanning at the admission counter which will generate a unique EMPI for each patient. • Complete information for every patient can be accessed through HIS.
AB-ARK DESK/CLAIMS:	ENQUIRY Total statistical report is needed • Claims/settlement report is required based on discounts • report of all the details of discount like how much discount is provided and provided by whom should be shown in statistical report • Claims should be integrated with HIS for each patient entry if required. • Barcode scanning for each patient	• Claims can be digitized for a completely digital care experience.
OPD NURSE STATION:	• Lab investigation should be accessed by them so that patient management is made easier based on the severity of the patient. (LIS requirement)	• Queue management with help of check-ins and slot management • QMS allows scheduling completely digitally and the Doctor secretary has complete access to booking slots, manages

	• Bed management feature to be added. • Statistical view is needed • Inventory should be integrated with HIS and modifications can be done by nursing supervisors.	calendars of patients, and blocks and manages time slots of their respective doctors. • Inventory management will be digitized.
CASH COUNTER:	Modifications cannot be made (can't modify the payments at last). • Multiple cash counters don't communicate with each other, which leads to multiple entries. • Payment status not reflected in billing. No integration with HIS except for the demographic data. • System is hanging when we are searching for the single data • Need to capture the payment mode (cash, cheque, credit card etc.) during deposits at the cash counters and the same to be reflected in their forms	• Billing will be digitized and simultaneously entered at the time of registration to avoid duplication • Multiple options of payments are provided.
NABH QUALITY DEPARTMENT:	• The NABH department is not integrated with any other department so the collection of data is manual. • Need software for capturing data,	• Data collection is easier digitally and can be assessed and filled with pre-existing reports

	analyzing data and for corrective action.	
OPD CONSULTATION ROOM:	All pen and paper, to be updated in HIS	MetahOS provides a complete digital experience for the OPD.
ADMINISTRATIVE OFFICE	• Registration is manual • Details capture from registration book and rest relies on finance for processing payment • New appointment is done • All branches are handled here • Increments, encashment etc. • Looks after the salary part of the employees	All registration details will be digitized and data will be shared seamlessly with the accounts team. MetahOS can also integrate with the Payroll software.
PURCHASE SECTION (STORES):	• If the purchase department linked to the stores, then there will be a linkage of the workflow • Provision of item wise transaction in excel to be included • Provision of stock Ledger report, receipt report and issue report to be incorporated	MetahOS will maintain the stored data and link it with different departments.
ACCOUNTS SECTION:	• Need entire HR/payroll/ IT system • Check printing is	HR payroll/IT system is digitised on MetahOS

	manual • Tally is used • The State department has software and they use it. • Most of the process is manual here • No integration with HIS	
BIOCHEMISTRY DEPARTMENT/MICROBIOLOGY DEPARTMENT/PATHOLOGY DEPARTMENT:	• Separate login IDs for employees • Barcodes should be scanned • All the information should be updated, and pre-printed format should be there. • Different departments should have separate logins and they should enter fields department wise. Editing rights should be reserved to them only. • instrument application is not linked for the separate login • need of superuser concept so that only few persons can change the data • bidirectional interfacing is there • no accounting as everyone is accessing • The status of the test results is not shown as pending, confirmed and complete. • reports are given to patients without confirmation from	• MetahOS allows for all employees to have their own login IDs. • Separate logins for each department. • Status of reports can be assessed

	different laboratories and are directly assessed in wards and ICU without confirmation and given to the patient. • inpatient not integrated with HIS. • Biochemistry departments need NABL standards. • Here test is performed three times so to remove the error but the reports before the test are accessed in the wards and ICU and without confirmation send to the patient • The system is integrated and standalone. • Transfer of the data is done by anyone without knowing the information and user employees are not identified.	
CATH LAB:	• No integration with HIS • Need store inventory for the materials that is being provided to the patient • Cath lab report is done manually. • Need PACS integration to view for each patient • Software needed to view. • Need to have a report entered for each patient (right now done manually).	• Inventory will be maintained • Cathlab processes, reporting and assessment will be digitised with MetahOS.

	Reports such as angiogram report, PTCA report, Device procedures, Valve procedures, Cath Lab procedures etc,	
WARD/ICU:	• Store Inventory maintained manually • No system discharge. • All the assessment, checklists by nurses in wards and ICU are filled manually. • Patient entries done manually. • Details by doctors entered manually. • No pharmacy details entered • Need integration of all details from imaging to laboratory tests related to each patient for every patient in the system. • Reports are entered manually. • Need integration with HIS for-patient details in Wards and ICU. • Weekly, daily indents made manually.	• MetahOS Analytics Engine can provide reports and dashboards using the Daily, Weekly, Quarterly and Monthly filters. Formats for existing reports can be templated for ready publication. All the orders for Pharmacy, Lab, Procedures will reflect in the Inventory itself

CONCLUSION:

A cost-effective platform is provided by MetahOS, the next-generation Electronic Medical Record (EMR), to handle all your marketing, sales, and referral management requirements. Organizations may get real-time information on measures like blood donation events, health camps, and sales calls through its modern interface. You may use the numerous

capabilities of MetahOS' all-encompassing software to generate results and get the most out of every investment.

Benefits of EHR (MetahOS) platform in a hospital setting:

1. Reduce patient waiting time for Walk-in and Appointment patients
2. Streamline processes for outpatient departments and Consultations.
3. Reduce load on the front-line office.
4. Multiple channels for connecting patients with care providers.
5. Enhanced communication channels through our platforms.
6. Decrease patients' No-Show rates.
7. Integrate all applications into one umbrella.
8. Increase patient acquisition, retention, and referrals

Using an omnichannel patient-centric approach, MetahOS intends to enable hospitals to create a positive, lasting relationship with patients, which is based on the idea of the patient staying connected with the care providers. This will in turn result in efficient and consumer-driven marketing that has an indisputable Return on Investment.

In order to make health information more accessible, MetahOS patient relationship management features include digitising health records and even mapping the locations of patients within a provider facility. Focusing on the patient experience and their communications with the hospital is another important factor. This might involve using a follow-up system that automatically queries patients about their experiences with care after they have left the hospital or keeps them updated on their medical problems and ongoing care.

REFERENCES:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3804410/>

<https://pubmed.ncbi.nlm.nih.gov/16162551/>

<https://pubmed.ncbi.nlm.nih.gov/18066363/>

<https://pubmed.ncbi.nlm.nih.gov/15470818/>

<https://pubmed.ncbi.nlm.nih.gov/23407861/>