THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH AND SOCIAL WELFARE

Integrated Hospital Management System (iHMS)

Implementation Guidelines

Version 1.1- 26th August 2015

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

FOREWORD

The mission of the Ministry of Health and Social Welfare (MoHSW) is to facilitate the provision of quality and accessible health services efficiently. Despite the noticeable improvement towards this mission, the sector still faces several challenges. These include inadequate funding, rising health facility management costs, shortage of healthcare workers and inefficiencies in the use of available resources to adequately provide required health services. To overcome these challenges the ministry has implemented various reforms in the health sector.

Among the reforms, in the health sector, implemented by the ministry is the introduction of cost-sharing scheme in attempt to raise additional revenues from health facilities (HSSP III, 2009). To achieve maximum benefit, the ministry needs to address at least two concerns emanating from this reform. The first concern is to ensure all genuine revenues are collected, recorded and reach relevant authority. To address this concern, the ministry should put in place implementable mechanisms for ensuring effective revenues collection. It is worth to note that the reform came to replace the old system where majority of health services were free for all and the new cost –sharing scheme came with some fee –waive components for some vulnerable groups. Thus, effective and efficient revenue collection under cost-sharing scheme requires review and re-engineering of hospital business processes. The second concern is controlling expenditure and service delivery at the health facilities. All of these require re-engineering of hospital business processes in order to increase net income and reduce the impact of shortage of funds in delivering accessible, efficient and quality health care services.

Parallel to re-engineering hospital business processes, automation of well-defined hospital business process is vital for improving management of scarce resources, reducing workload and increasing productivity. To achieve best results of controlling health resources, the automated system must be able to capture process and disseminate relevant information across all functional units within a health facility and possibly from health facilities to the ministry. This necessitates the need to have an integrated Hospital Management System (iHMS) that implements the re-engineered hospital business processes in order to facilitate effective and efficient health resource (include medicine, financial and human capital) management. This is in line with the strategic objective 4 (SO4) of the national eHealth Strategy (2013-2018), which focuses on the use of information technology on financial and resource management.

iHMS, when well implemented can improve the quality of hospital operations while preventing loss of revenue, medicines and other medical supplies. The iHMS can also enable patient tracking to increase productivity of inpatient allocation and provide effective administration and control. iHMS supports integration between functions for smooth patient movement within various services. To ensure successful implementation and use of the iHMS, a national guideline is fundamental. The iHMS implementation guideline for Tanzania aims to provide guidance for development of iHMS and set an environment for successful implementation and use of the iHMS. It is a directional document that describes minimum

requirements, standards and guidelines for successful implementation and use of the iHMS in Tanzania private and public hospitals. This document builds on the feasibility study, which was carried out to assess the feasibility of implementing hospital management system in Tanzanian hospital setting. It is a product of consistent work carried out by the ICT Unit of the Ministry of Health and Social Welfare with inputs from stakeholders through a participatory process.

The adoption of this guideline will improve the ongoing reforms in Tanzanian hospital setting. In addition, this guideline will address some of the key challenges experienced by health facilities implementing hospital management systems and other related electronic systems that include a lack of proper governance, diverse scope of functionalities, and lack of standards hampering data exchange and information sharing.

The iHMS implementation guideline is applauded as a useful guide to the next steps for Tanzania in its eHealth journey. The document is understandable and therefore will help to lead Tanzania toward providing quality healthcare by making management of hospital more efficient and effective.

Hon. Dr. Seif Rashid, MP
Minister of Health and Social Welfare

ACRONYMS & TECHNICAL GLOSSARY

HMIS	Health Management Information System
iHMS	Integrated Hospital Management System
HQ	Headquarters
ICT	Information and Communication Technology
LMIS	Logistics Management Information System
LAN	Local Area Network
M&E	Monitoring and Evaluation
MOHSW	Ministry of Health and Social Welfare
ERP	Enterprise Resource planning
SDP	Service Delivery Point
SDP	System Development Plan
SO	Strategic Objective
SOMD	System Operation Maintenance Document
SOP	Standard Operating Procedure
SRS	System Requirements Specification
TZ	Tanzania
PACS	Picture Archiving and Communication System
SMS	Short Message System
DHIS2	District Health Information Software version 2
HL7	Health Level 7
ICD	International Classification of Diseases
QRDA	Quality Reporting Document Architecture
SNOMED CT	Systematized Nomenclature of Medicine - Clinical Terms
SDMX-HD	Statistical Data and Metadata Exchange - Health Domain
WHO	World Health Organization
BPR	Business Process Reengineering

Term	Definition
Business process reengineering (BPR)	A business management strategy focusing on the analysis and design of workflows and business processes within an organization.
A functional requirement	A requirement that describe in details the programmatic or project needs and/or requested behavior of a system or component. It specifies what the finished system or component is expected to do and how a user will interact with it.
A non-functional requirement	A requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors
Statistical Data and Metadata Exchange - Health Domain (SDMX-HD)	A data exchange format developed by WHO, to facilitate exchange of indicator definitions and data in aggregate data systems.
Health Level 7 (HL7)	A flexible standard by which various health care systems can communicate with each other; it is typically used for transmission of patient level data.
Quality Reporting Document Architecture (QRDA)	A standard for communicating health care quality data. It is developed on the HL7 Clinical Document Architecture model.
International Classification of Diseases (ICD)	A statistical classification system used to assign diagnostic and procedural codes in order to produce coded data for statistical analysis, epidemiology, reimbursement and resource allocation.
Systematized Nomenclature of Medicine -- Clinical Terms (SNOMED CT)	A clinical terminology designed to capture and represent patient data for clinical purposes
Electronic medical record (EMR)	An electronic record of health-related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization.
Integrated Hospital Management System (iHMS)	A single system or collection of integrated systems that automate both clinical and administrative processes in the hospital settings.
Management information	A computer-based system that provides managers with the tools to

system (MIS)	organize, evaluate and efficiently manage departments within an organization.
Interoperability	Ability for a system to securely communicate and exchange data in an accurate, reliable, and meaningful way the with another information system so that the clinical or operational purpose and meaning of the data are preserved and unaltered.

EXECUTIVE SUMMARY

The Integrated Hospital Management System (iHMS): requirements, standards and implementation guidelines; is a directional document that describes minimum requirements, standards and guidelines for successful implementation and use of the iHMS in Tanzania private and public hospitals. It also describes the leadership and governance structure, centered on the National eHealth Steering Committee (NeHSC) that will help ensure the timely implementation of eHealth initiatives.

The iHMS guideline intends to address challenges eye-marked by the feasibility study which among other things examined the challenges faced by existing hospital management systems in the Tanzanian landscape. The study revealed that implementation of the existing systems suffered a number of challenges such as lack of proper governance, diverse scope of functionalities, and lack of standards hampering data exchange and information sharing.

A concise definition of iHMS: is a single system or collection of integrated systems that automate both clinical and administrative processes in the hospital settings.

The iHMS guideline document is an important component of the strategic objective number two (SO2) implementation of the National eHealth Strategy which seeks to establish nationally adopted standards, rules, and protocols to enable the implementation of affordable, cost-effective, and accessible technology that complies with these standards.

The document has been developed through a participatory process, carried out with inputs from stakeholders through focused group discussions, interviews, and with extensive review of the iHMS feasibility study report.

Vision of the iHMS Initiative

The Ministry of Health and Social Welfare (MOHSW) envisions an integrated national health information system (HIS) that has, as its components, the iHMS that support provision of quality healthcare by making management of hospital more efficient and effective.

Requirements and Standards

The document stipulates the minimum requirements and standards the iHMS must meet to ensure that it creates the value and the utility to its stakeholders. The requirements include both the following:

Functional Requirements

Functional requirements capture the intended behavior of the iHMS expressed as services, tasks or functions the system is required to perform. At minimum the iHMS should cover the following functional requirements areas: Patient Care Management, Laboratory, Billing, Pharmacy and Inventory, Medical Record Management, Human Resource Management, Financial Management and Management Information System (dashboard).

Non-Functional Requirements

Non-functional requirements define the overall qualities or attributes of the iHMS that place restrictions or conditions on the development process, and specify external constraints that the system must meet such as usability, access security, availability, efficiency, integrity, reliability, and scalability.

Standards

It is required that the iHMS be able to share and exchange information with other system in the health sector. This can be achieved through creation, acceptance and implementation of clinical data standards such as Health Level 7 (HL7) and coding standard such as the International Classification of Diseases (ICD).

Computing Infrastructure Requirements

The computing infrastructure will support the hosting of applications and provide communication and system platforms for users to access and use the system. They include the data center (server room), network and Internet connectivity, workstations, and computer training laboratory.

Human Resource Requirements

Successful iHMS implementation requires a mix of the right people with minimum competencies as key role players in the system implementation and operational processes. Taking into consideration the complexities of hospital setting, involving precarious situations of serving lives, to ensuring that the iHMS is functional 24/7, there should be a good mix of the following cadres to support its operation: IT System Analysts, System/Network Administrator, ICT support technician and Data/Medical Record Clerks.

Implementing iHMS

Coupled with the minimum requirements and standards that the iHMS must meet, in order to ensure successful implementation and use of the iHMS in a hospital, the following activities grouped into three main phases should be adhered on to: planning, deployment, and maintenance and support.

Planning

The implementation of the iHMS requires careful planning to ensure that the implementation proceeds in comprehensive, cost-effective and timely ways. This involves a range of activities including establishment of the governance structure, budgeting, development of the implementation work plan, acquiring the iHMS software, readiness assessment and procurement of the required computing infrastructure.

Budgeting

Implementation of iHMS is a complex and challenging task. One obstacle to successful implementation can be the cost of converting to an electronic system when insufficient health care funding has been budgeted. It is essential that hospital management and stakeholders involved in planning for iHMS implementation understand what funding is available and develop a timeframe for funding in conjunction with timetables for implementation.

Deployment

Deployment of the iHMS includes the following activities: installation of the computing infrastructure, installation and configuration of the iHMS software, iHMS software acceptance testing, and training. Most importantly the training should include the following: basic computer training, iHMS software end user training, network and system administrators training and ICT governance training for managers.

Maintenance and Support

Maintenance and support of the iHMS system operations is an essential ingredient in making iHMS adoption successful and thus achieve the intended organizational goals. For all users to efficiently and effectively use iHMS properly plan should be devised and operationalized which should include maintenance of the computing infrastructure and the iHMS system, continuous end user training and support, disaster preparedness and recovery plan, regular assessment of system usage, modifications and enhancements of the system and IT infrastructure.

Monitoring and Evaluation

As part of iHMS implementation, it is necessary to track and evaluate the implementation and functioning of the system, to understand how well the implementation activities have been met and the effect of the new system in the hospital operations.

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Dr. Donan Mmbando
Permanent Secretary

1 PART A: BACKGROUND AND VISION

1.1 Background

The Ministry recognizes the potential of information and communication technology (ICT) in transforming healthcare delivery by enabling information access and supporting healthcare operations, management, and decision-making. In response to this the National eHealth Strategy was formulated to guide such a transformation. One of the key areas targeted for transformation is the use of ICT to make health facilities more effective and efficient. This necessitates the need to have an integrated Hospital Management System (iHMS) that implements the re-engineered hospital business processes in order to make hospital become effective and efficient.

Efforts to computerize various clinical and administrative functions have been noticeable worldwide, and in some health facilities in Tanzania. While there is significant improvement in management of health resources, the degree of success on automation has been varying significantly, with some obtaining poor results. In order to ensure successful implementation of the iHMS, feasibility study was conducted to determine the requirements and the possible challenges that could affect the implementation and use of the iHMS. The feasibility study revealed the following among other.

Lack of proper governance:

The study revealed lack of proper governance in implemented information systems for hospital business processes. Acquisitions, deployment, operationalization of many existing systems were handed in ad-hoc way resulting in either insufficient utilization or poor performance.

Diverse scope of functionalities:

The study revealed diverse scope of functionalities being implemented by hospitals. Existing information systems cater for fragmented functionalities relative to a range of activities in a typical hospital setting. There is neither criterion for establishing functionalities of high priority for automation nor established minimum set of requirements for the same. Thus, data sharing among these information systems is difficult.

Lack of standards:

Standards are essential for ensuring interoperability. The feasibility study revealed that many information systems were implemented without focus on standards. Thus, facilitation of information exchange between two or more different systems is a challenging exercise.

One possible approach to addressing the above mentioned challenges that is well acknowledged is to establish a national-driven iHMS implementation framework that constitute (1) a minimum set of requirements that the iHMS must meet to provide the value and utility to the stakeholders, (2) a minimum set of standards that the iHMS system must support to ensure interoperability and therefore information exchange and sharing between eHealth systems, and (3) a set of guidelines that must be followed for successful implementation of the iHMS. In response to this, the Ministry has developed the requirements, standards and implementation guidelines for Integrated Hospital Management System.

1.2 Vision of the iHMS Initiative

The Ministry of Health and Social Welfare (MOHSW) envision an integrated national health information system (HIS) that has, as its components, the iHMS that support provision of quality healthcare by making management of hospital more efficient and effective. Central to this vision is the need to have systems that can:

- Streamline the medical / administration work flow
- Provide seamless integration between functions for smooth patient movement within various services
- Prevent loss of medicines and other medical supplies
- Enable patient tracking to increase productivity of inpatient allocation
- Ensure instant Patient Billing
- Provide real-time management and accounting report.
- Provide effective administration and control

1.3 Purpose of the document

This document provides requirements, standards and guidelines to Health Facilities as well as developers and implementers, who want to implement or are currently using iHMS to ensure that the implementation of iHMS have value and utility to its stakeholders.

The requirements, standards and guidelines have been drawn from both the stakeholders and references to local and international documents including:

- Tanzanian National eHealth Strategy
- Health Sector Strategic Plan III
- Comprehensive Hospital Operation Plan
- Report of the Feasibility Study on the implementation of the Integrated Hospital Management System
- WHO eHealth Development Toolkit

1.4 Audience

This document is intended for the following audiences:

- Public and private health facilities which are considering to procure, adapt, or install iHMS
- Health facilities who are currently using the hospital management system
- Developers of hospital management system
- Healthcare managers and policy makers
- All other healthcare stakeholders

1.5 Structure of the document

This document, ***the Integrated Hospital Management System: requirements, standards and guidelines in Tanzania,*** are organized in four parts, A, B, C and D. In this, Part A, ***Background and Vision***, we have explained the motivation of the work, described the challenges experienced by the healthcare systems, described the vision of the iHMS initiative, the purpose of the document, and the target audience. The rest of the document is organized as follows.

Part B presents the business process analysis and improvement.
Part C presents the requirements and standards for the iHMS. This part consists of Chapter 2 and Chapter 3.
Chapter 2 Outlines the minimum set of requirements that must be met by the iHMS for it to have value and utility to its stakeholders. These include both functional and non-functional requirements. Also Chapter 2 Describes the minimum set of standards that must be supported by the iHMS to ensure that iHMS is interoperable with other systems within the integrated national HIS and therefore can share and exchange information.
Chapter 3 Outlines the necessary set of computing infrastructure and human resource requirements that must be available to provide conducive environment for the iHMS implementation in the hospital.

Part D provides a set of guidelines for successful implementation and use of the iHMS. This part consists of Chapters 4, 5 and 6. These Chapters outlines a set of guidelines related to planning (Chapter 4), installation (Chapter 5), and maintenance and support (Chapter 6) phases of the iHMS implementation. Included in this Part is Chapter7: Monitoring and Evaluation, Chapter 8: iHMS Implementation Closure and Signoff, and Chapter 9: Guidelines for Accessing Compliance of iHMS

2 PART B: HOSPITAL BUSINESS PROCESS ANALYSIS AND IMPROVEMENT

Description

Acquisition and implementation of iHMS may entail to do hospital business process reengineering that involves a critical analysis and redesign of workflows and work practices of existing business processes within the hospital setting in order to maximum the value of the computerization process.

Figure 1 presents an overview of the hospital business processes framework, which includes business processes classified as core processes, support processes and back office processes. The framework presents a high level representation of how a typical hospital operates. This section provides guidelines and procedures for process improvement, and process map (flow of activities) for each business process to be supported by iHMS.

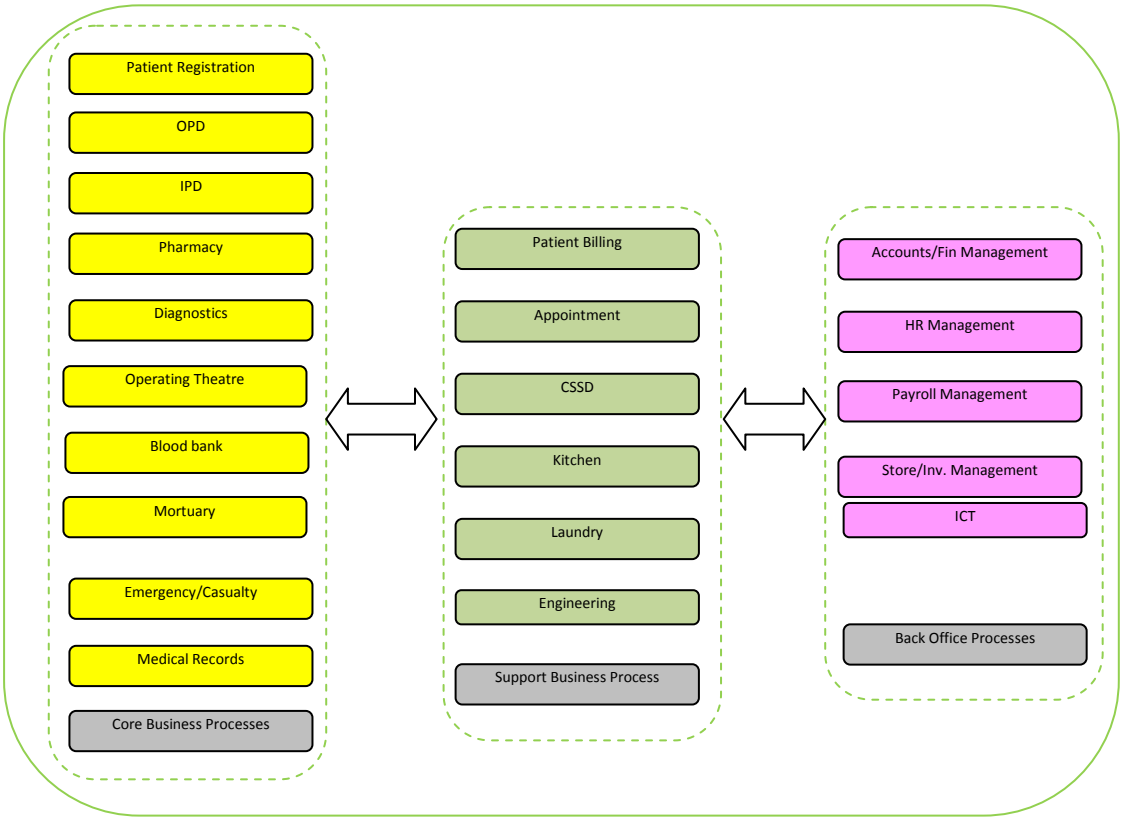

Figure 1: Hospital Business Process Framework

Objective

To provide guidelines and procedures for business process analysis and improvement in order to help health facilities rethink and improve their business processes

Scope

The guidelines and procedures shall be used by all functional areas in the hospital during acquisition of new iHMS or reviewing and enhancing an existing hospital management system.

Standard Guidelines

- Health facilities shall perform business process analysis and improvement based on the national guidelines and standards
- The business process analysis and improvement should be done along side with iHMS system requirement specifications (SRS) gathering exercise
- The SRS shall be developed by the vendor and project implementation team
- The SRS shall include both functional requirements and non-functional requirements and shall be approved by the hospital iHMS steering committee

2.1 Patient Care Management

Patient care management processes is one of the core business processes of the hospital in the framework (Figure 1). Major processes which need improvements within the patient care management in the hospital include registration, admission, laboratory, radiology, discharge and appointment scheduling.

i. Patient Registration

Patient registration process involves activities such as capturing of accurate demographic details for new patients, updating of the information for follow up patients, creating correct clinical patient record depending on the nature of health problem and deciding on the required mechanism of payment of bills. Refer Figure 2 for further details.

Standard Guidelines for process improvement

- Integrate patient registration and verification activities to be performed at the same center to avoid multiple patient queues.
- Eliminate corridor/unregistered patients from being attended by clinicians by providing integration and information sharing between registration and consultation using iHMS.

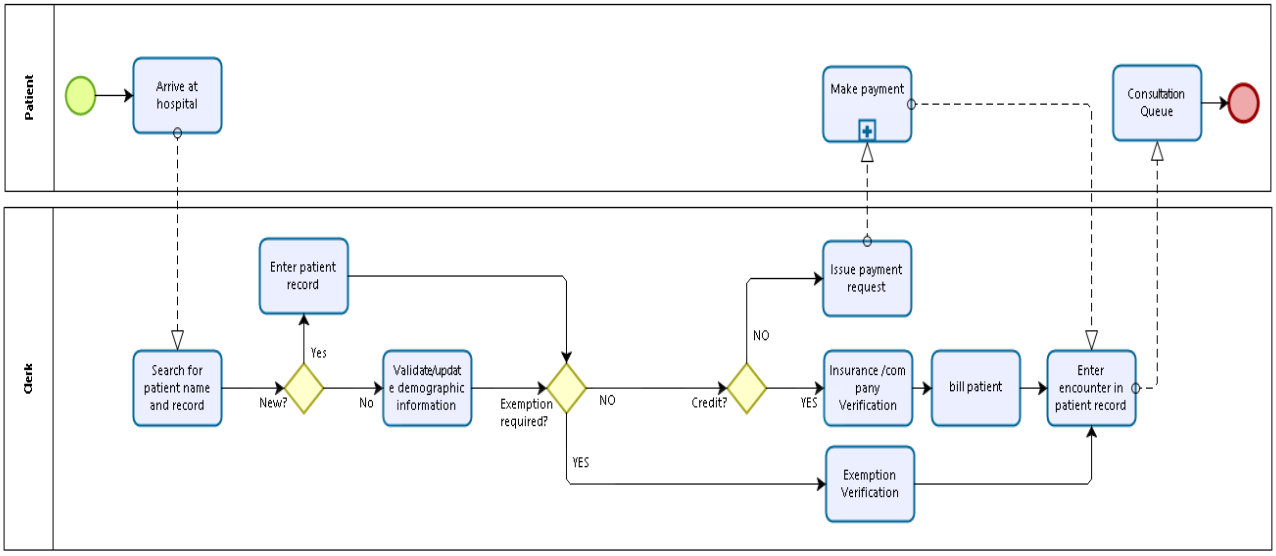

Figure 2: Patient Registration Process Map

Procedures

At minimum patient registration process should have the following procedures:-

1. Patients arrive to the hospital reception for verification. The clerk checks the patient registration (new or existing)
2. Identify whether the patient has an existing record or is a first-time user.
3. *Enter patient record.* Create a patient record in the system for new patients. Record demographic information with proof of identification.
4. *Existing patient.* Search and retrieve patient record through identifying information collected. A search needs to be done first on all patients in order to avoid duplicates.
5. *Validate/update demographic information.* Display patient information that can be edited for updates so the clerk can verify identification of patient.
6. *Exemption required.* Identify whether the patient is entitled for exemption.
7. *Exemption verification.* Verify to determine whether the patient is exempted or not.
8. *Credit patient.* Check whether, the patient is a credit or a cash client.
9. *Credit verification.* For credit patient, the clerk will verify and register the patient, and provide patient with a form to be filled at each step of service provision. Insured claim form will be signed by parties, the patient and doctor, the insurance card will be kept by the clerk and provided to the patient at the end of services.
10. *Issue payment request.* For cash patient, the clerk will provide cost of all services and provide payment sheet to patient for settlement.
11. *Bill patient.* For credit patient, clerk will prepare bill for each service provided
12. *Make payment.* The cash patient will settle the payment to the revenue collector

13. *Enter encounter to patient record.* Document current encounter to create record of the visit.
14. *Consultation queue.* Nurse will assign order according to the prioritization process based on time of arrival. Wait for clinician to conduct consultation.

ii. Admission process

The admission process consists of various functions required to receive a patient at the hospital. The purpose of the process is to obtain required information, and determine patient care needs. A patient can be received at various departments or units in the hospital such as at the Emergency, or inpatient. Nurses will register the patient in the registration books or check from the computer if the patient is already registered in the specific ward. Refer Figure 3 for details of this process.

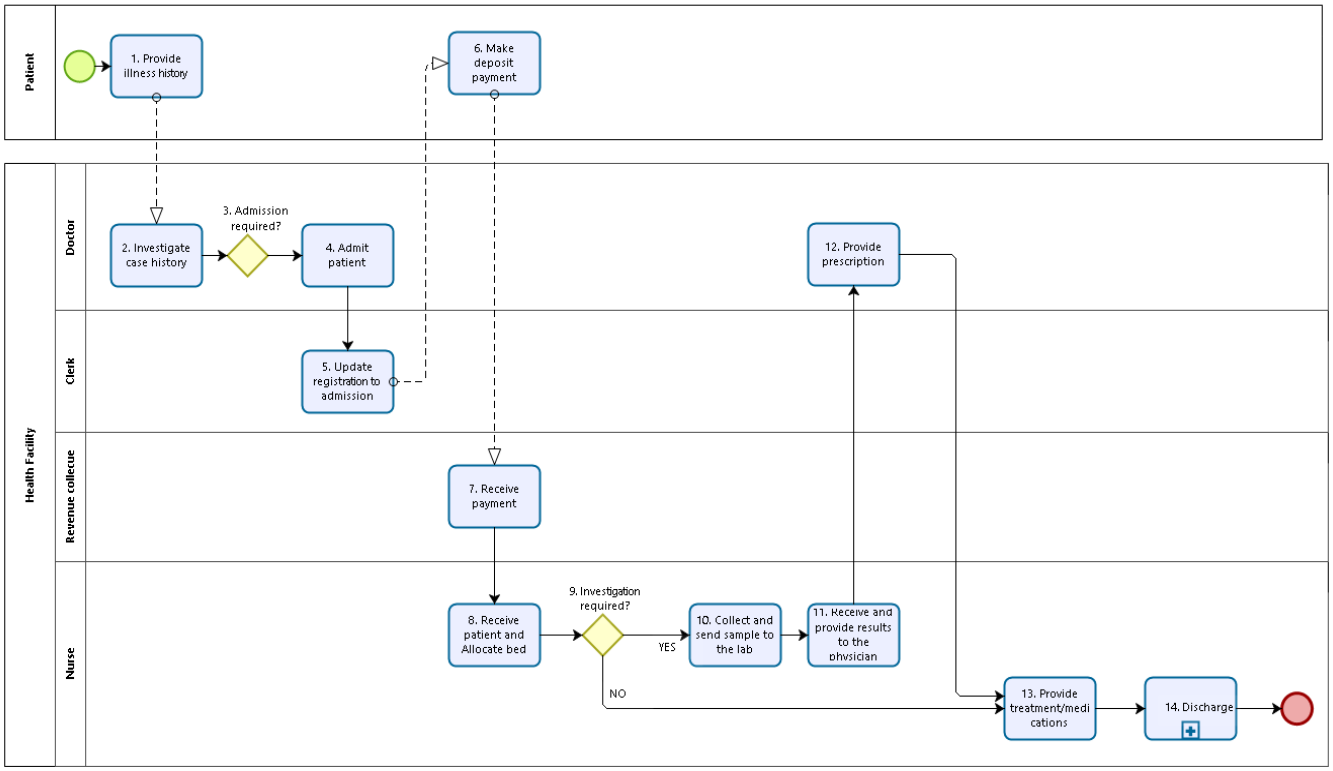

Figure 3: Admission Process Map

Procedures

In order to improve patient admission process the following procedures should followed:-

15. Provide illness history. Patient meets the doctor; provide a detailed history of his/her illness.
16. Admit patient. In case of admission, the patient is given the admission date and admission form is filled for further formalities

17. Update registration to admission. Before admission, the patient is registered as admission and is counseled/clearly informed by the clerk regarding the treatment package, which includes estimated bill size, average length of stay and various mode of payment accepted.
18. Investigate case history. Doctor records detailed medical history background, observes the vital signs and requests various investigations depending on the condition to determine diagnosis. Doctor receives the results and plan for treatment. Also, decision is made based on the findings. Patient may be instructed to take appointment and continue with treatment as outpatient.
19. Make deposit payment. Cash patient are required to make deposit payment on the estimated cost established by the Hospital policy. Otherwise for insurance or credit patient, the clerk issue bills for the service rendered and claim forms are filled properly.
20. Receive payment. Revenue collector receives the payment and issue receipt to the patient.
21. Receive patient and allocate bed. When the patient arrives at the ward, a nurse receives the patient and allocated him/her a bed. The patient is then attended by the clinician on duty, which involves taking/reviewing the detailed medical history and order the appropriate tests.
22. Perform the required investigation/test. Investigation/tests are performed and included in the bill properly
23. Billing notification required? The ward nurse liaises with billing section to get the cost and inform the relatives to pay. In some hospitals investigation bills are issued after service delivery.
24. Receive and provide the test result to the physician/clinician. The nurse receives the results of the test and makes them available to the doctor.
25. Provide treatment/administer medication. The doctor receives tests results, plans the medication to be administered to the patient. Nurse receives medication plans from the doctor for execution.
26. Recovery and Discharge. After recovery patient is handed over with detailed discharge summary, which includes doctor's advice for further follow-up treatment and medical description. However, patient must settle the outstanding bills/charges before being handed the discharge summary. The doctor may give appointment for follow-up and that will be verified at outpatient clinic.

iii. Diagnostics Processes

Diagnostics services (laboratory and radiology) have an important role in the provision of health care services. The activities of the laboratory process includes: receiving test orders from clinicians, specimen collection, specimen identification, preparation and transport, analysis, result reporting and interpretation. The activities of the radiology process includes: receiving patient who need a test, perform the test, analysis, result reporting and interpretation.

Guidelines for process improvement

- The laboratory and radiology machines should be integrated with iHMS such that only already billed or paid for samples and tests appear on the machine software for testing. This ensures that Laboratory technicians attend to the only billed or paid for samples and tests. The integration will remove the loopholes and increase revenue to the Hospital.
- The laboratory/radiology technician should be given an option in the iHMS to disable temporarily all the tests, which may not be available due to reasons such as no reagents, machines out of order or under maintenance. This will alert the revenue clerk through warning messages.
- With iHMS, doctors/nurses will be able to track progress status of samples/investigations sent to the laboratory or radiology section. Doctors/nurses do not need to wait for laboratory/radiology technicians to manually deliver results that are ready.

Procedures for Laboratory Process

In order to improve laboratory process the following procedures should followed:-

1. *Order /sample booking.* The order booking process begins with a request for investigations by doctors. Patients' information and test requests are recorded in request forms and passed on to phlebotomists to collect samples from patients.
2. *Billing and Payment.* The request forms are sent to cashiers for payment or billing for the requested tests before proceeds for laboratory process.
3. *Sample/specimen collection.* The activity of collecting the booked samples from different booking sources may be done by doctors, nurses or Phlebotomist.
4. *Sample receiving and acceptance.* This is a process where samples are received and accepted for all orders released. The process involves the laboratory technician to check samples are qualified to process. A list of sample orders with the order number, date, time and the patient details verified and recorded.
5. *Rejection of Samples.* The samples, which are not qualified, are rejected and request forms are returned back to the source. Reasons for rejections may be wrong container, clotted, expired etc
6. *Results reporting.* The samples qualified are processed. The Laboratory Technician reports the findings for the processed tests.
7. *Results approval and delivery.* Approval of the test results and authorizing for delivery of the report to the patient or the ward/clinic or outside agencies in case some reports belong to the outside agencies.

Procedures for Radiology Process

In order to improve radiology process the following procedures should followed:-

1. *Order of Sample.* The request form or order is raised by clinician indicating queried diagnosis or symptoms and the required radiological test. The booking of test is done depending on the nature of test.
2. *Billing and payment of test.* On the date of test the request form is passed to finance section for billing or payments depending on the patient's category.
3. Conducting Test. The test is performed after payment for cash paying patients or billing process for those under Insurance/credit companies.
4. Reporting. Reports are forwarded back to the clinic through patients or relative after reported and verified by technician or radiologist.

iv. Scheduling Appointment

The appointment scheduling process allows health worker to make patient appointment with preferred date and time to obviate the necessity to sit in queues and wait for consultation. The patient contacts the hospital by agreed means of communication; say by telephone, personal contact, email etc., and books an advance appointment with the choice doctor/department on a given date and given slot of time. The consulting doctor also would have the idea of the load on a given day in the hospital. Medical records of the patients visiting the hospital will have to be maintained and updated. Hence the file is handled to and from the consulting room and the medical records Department.

Guidelines for process improvement

- The appointment should be done by a doctor through the iHMS to make the proper decision of the required dates. Having a different person scheduling the next appointment date for follow up patients may distort the planned treatment of the doctor.

Procedures

To ensure proper allocation and management of appointment based on the condition of the patient the following procedures should followed:-

1. *Doctor issue appointment date.* After Consultation/treatment clinician provides the tentative time for patient to revisit the Hospital. Also the doctor may transfer the patient to another clinic based on the case of the patient.
2. *Clerk verifies the appointment.* Patient submits the card to records clerk where the exactly date and time is issued as per system.
3. *Scheduled date not available.* If the date preferred by clinician is not available, the clerk may look for the nearest available date. Clerk allocates the patient to a clinic, doctor and time.
4. *Records clerk issue appointment slip.* Clerk issues the printed slip to the patient indicating t*h*e date, time and clinic or clinician for next visit.

5. *Instruction on appointment.* Health records clerk inform the patient clearly on timely reporting and avoid missing of the scheduled date.

2.2 Pharmacy and Inventory Management Process

In hospital settings stores and inventory are commonly categorized into general and pharmacy store. The activities performed at the pharmacy store include acquisition, control, management, tracking and dispensing of medicine and medical supplies. Whereas the activities related to the general store involves acquisition, control, management, and tracking of non-medical goods. While both stores are very important, this guideline document focused on the analysis and improvement of pharmacy store. This is because the pharmacy store is an essential and extensively used facility in the hospital and in the health sector in general. It caters to outpatients, inpatients, and other treatment areas like operation theatre and clinical laboratory. Therefore the pharmacy store must efficiently be managed and organized to meet patient medication needs and comply with applicable laws and regulations and control medications throughout the hospital.

***Guidelines for process improvement*:**

- *Introduce sub stores*: The purpose of introducing sub stores, in regional referral, zonal referral and national hospitals, is two folds: (1) to reduce and control theft of medical supplies at the dispensing point by reducing amount of medical supplies. (2) To reduce the complexity of managing main stores.
- *Automation of stock management*: Facilities requires automation of stock management at various levels, the main store, sub store, and the despising point using the iHMS.

Following the introduction of the sub store section, the pharmacy and inventory business processes can be grouped into three main business processes: (1) Central inventory management process which includes activities ranging from requisition of medical supplies from MSD and other suppliers, receiving, storage, and management (2) Distribution process which includes activities for receiving request from the main store, and dispatch to, dispensing point, (3) Dispensing process that includes activities for delivering medicine to a patient. The process and the descriptions of the activities that reflect recommended improvements are discussed.

i. Central pharmacy management process

The central pharmacy management process activities include requisition, purchasing, receiving, checking and storing of medical supplies. Refer to Figure 4 for details.

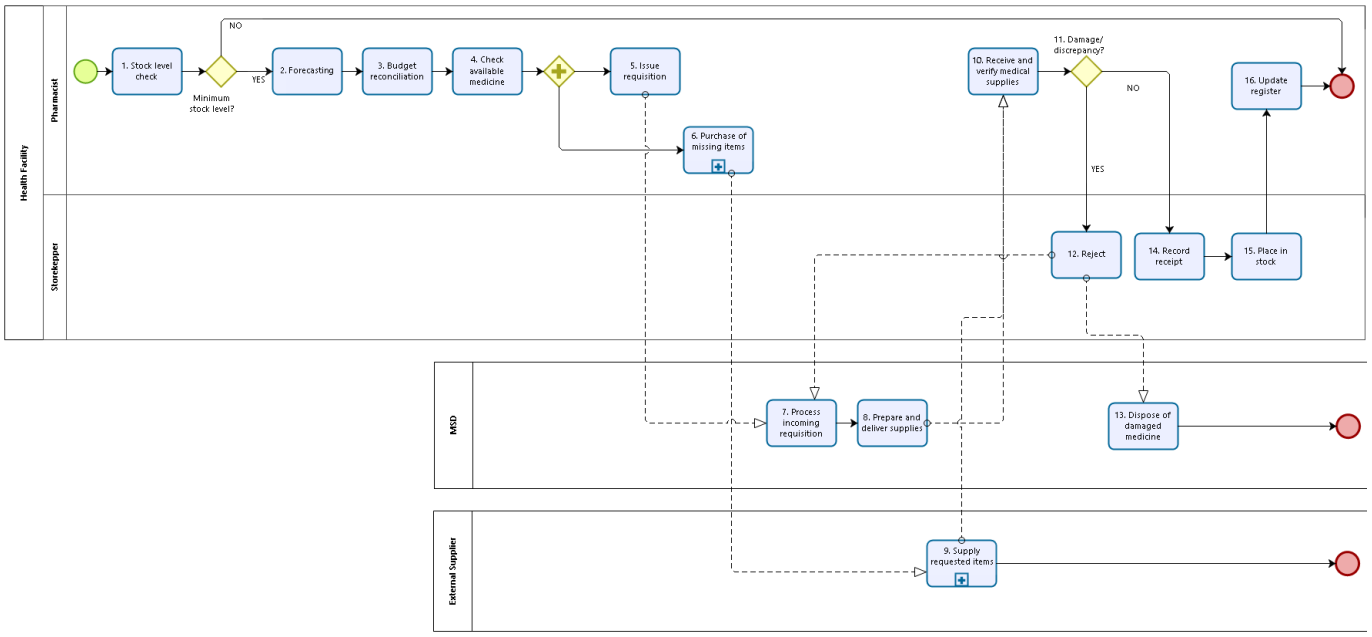

Figure 4: Central Inventory Management Process Map

Procedures for Central Inventory Management Process

To ensure the availability of the right medication at the right time, the right dosage, at the minimum possible cost in a proper manner the following procedures should be followed.

1. *Stock level check.* The pharmacist performs regular stock level check to determine whether medical supplies are to be ordered.
2. *Stock level check.* The pharmacist performs regular stock level check to determine whether medical supplies are to be ordered.
3. *Forecasting.* The user departments performs forecasting to aid the requisition/procurement process for ordering adequate stock and securing appropriate cold chain capacity throughout the health system. Forecasting can occur at multiple levels and use different methods of estimation. The most common estimation methods include target population estimation, previous consumption estimation, and estimation based on size of planned care service sessions.
4. *Budget reconciliation.* Provides the mechanism for calculating and ordering goods for stores at intermediate and service delivery points. The process may be performed with a push or pull system. Different rules and guidelines for estimating the need for stock are used to create the requisition. Transmitted requisitions are submitted to the appropriate store and then go through a validation and approval process.
5. *Issue requisition.* The pharmacist issue requisition based on the estimated need and the available budget
6. *Receive and verify supply request.* MSD receive and verify the request for processing/

7. Provide *profoma invoice and list of missing requested supplies.* The supplier checks the requested supplies against the available stock. The profoma invoice is provided for the available supplies along with any missing supplies.
8. *Receive profoma invoice and list of missing supplies.* The pharmacist receives profoma invoice with quantity and price respectively of available requested supplies, and the list of missed items.
9. *Procurement of missing supplies.* The User in collaboration with procurement unit completes the procurement of missing supplies from external suppliers.
10. *Receive and verify medical and other supplies.* The pharmacists or inspection team receive and verify medical supplies delivered.
11. *Damage/ discrepancy.* Check the delivered supplies if there any damage or discrepancy.
12. *Reject the damaged/discrepancy items.* The pharmacists/inspection team rejects the damaged items. The documentation is done.
13. *Supplier collects back the rejected items.* The responsibility of supplier to collects the rejected items from Hospital premises.
14. *Generate the Good Receipt Note.* The items received and accepted by the pharmacists/inspection team, GRN should be generated for further procedure.
15. *Update the updated physical stock.* The physical stock should be updated to reflect the received stock in main store.

ii. Medical supplies distribution process

The distribution process is triggered by a requisition. Individual requisitions can be received from service delivery locations when a "pull" system has been implemented or in the case of a "push" system can be regularly scheduled based on a previously completed distribution plan or standing orders. Allocation of stock for a requisition can depend on stock status within the store, competing needs of other service delivery, consumption patterns, or budgetary status. Refer Figure 5 for details.

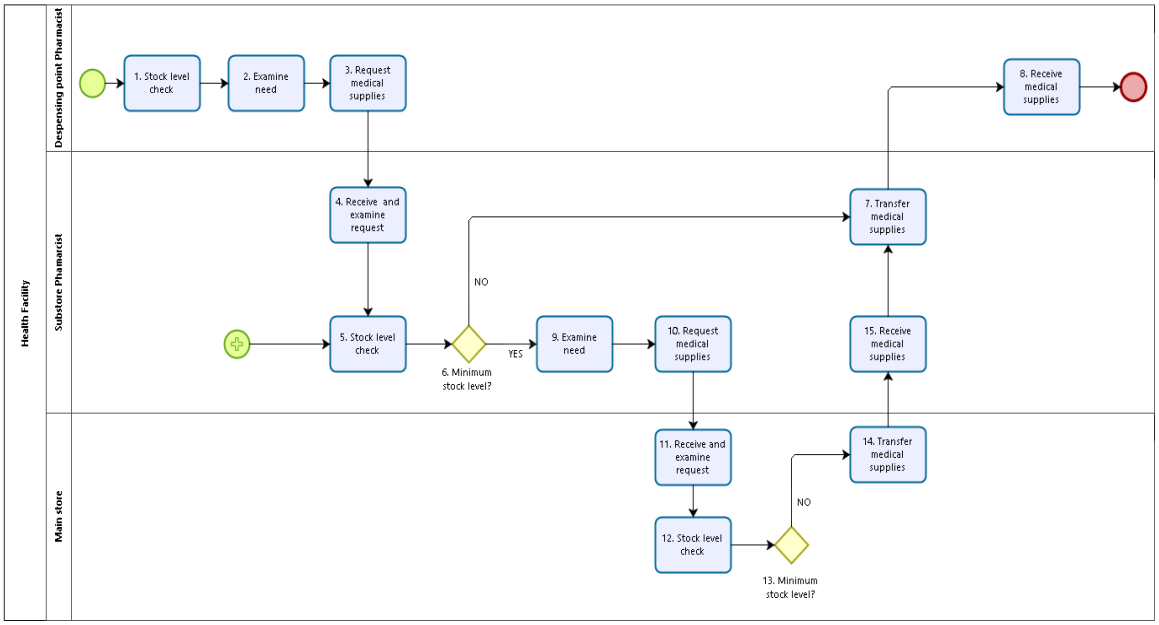

Figure 5: Medical Supplies Distribution Process Map

Procedures for Medical Supplies Distribution Process

In order to identify and prepare and deliver accurate quantities of medical supplies packed correctly from store needed at the pharmacy or any service delivery point the following procedures should be followed.

1. Stock level check. Pharmacist/technician at the dispensing point perform a stock level checks
2. Examine needs. Determine medical supplies needed at the dispensing point by calculating required quantities based previous consumptions, hospital guidelines and rules in consideration of minimum and maximum medical supplies stock level at the dispensing point.
3. Request medical supply. Issue requisition of medical supplies from the sub store.
4. Receive and examine request. The pharmacist at the sub store receives and examines the request of medical supplies from the dispensing point.
5. Stock level check. Pharmacist/technician at the sub store performs a stock level check to determine the availability of the requested medicines. The stock level check is also performed regularly to determine the general need of the sub store.
6. Transfer medical supplies. If the stock is available, the pharmacist at the sub store transfers medical supplies to the dispensing point.
7. Examine need. If the stock is equal to minimum, the pharmacist at the sub store examines the need for requisition from the main store.

8. Request medical supplies. The pharmacist issues requisition of medical supplies from main store based on the established need.
9. Receive and examine request. The pharmacist at the main store receives and examines the request of medical supplies from the sub store.
10. Stock level check. Pharmacist/technician at the main store performs a stock level check to determine the availability of the requested medicines. The stock level check is also performed regularly to determine the general need of the main store.
11. Transfer medical supplies. If the stock is available, the pharmacist at the main store will transfer medical supplies to the sub store.

iii. Dispensing process

The dispensing business process is a high-level and generic process designed to cover the full spectrum of health-related products including medicines, vaccines and other medical supplies. Dispensing begins with a client encounter and a determination of the type(s) of medication which the individual needs. If the medicines are available and in the correct quantity and quality, they will be dispensed to the individual and the client's record will be updated with appropriate information. This business process may trigger a scheduling process to inform the client of their next visit. Refer Figure 6 for details.

Guidelines for process improvement

- Use of iHMS to make information of available medicines accessible to doctors during prescription to eliminate patient movement and repeat of prescription for missing medicines.
- Enable online prescription verification by pharmacist to eliminate patient/pharmacist movement and queues to the pharmacist.

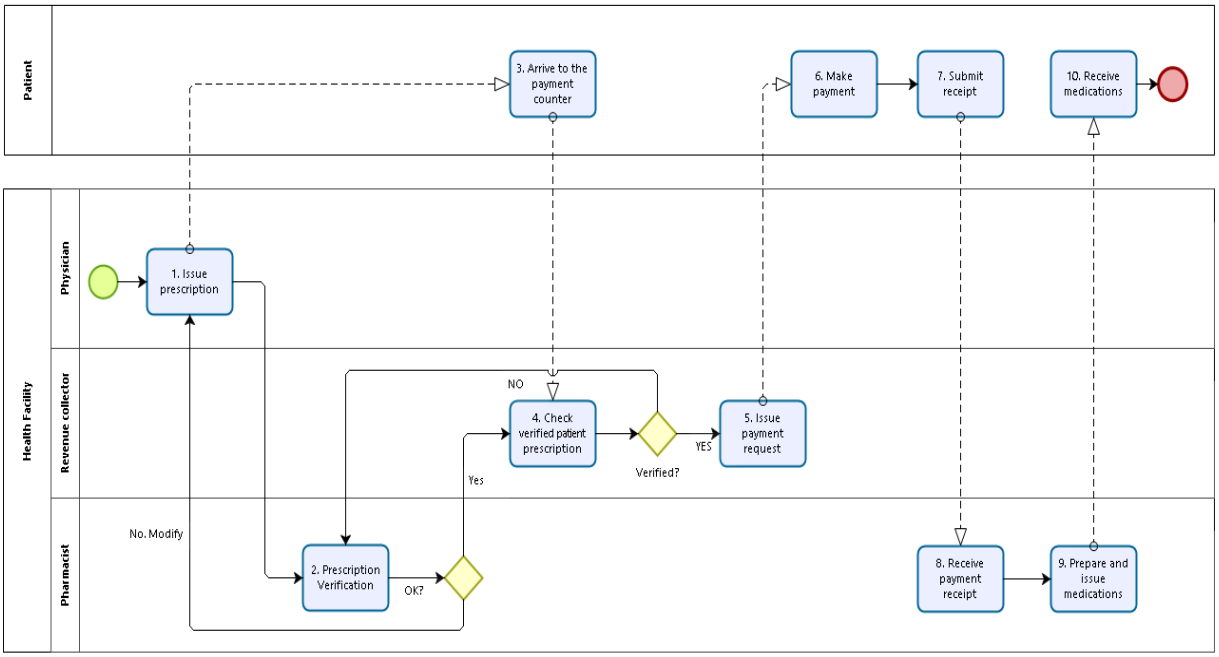

Figure 6: Dispensing Process Map

Procedures for Dispensing Process

In order to effective dispensing of right quantity and quality of medicine to the right client with right information for proper use the following procedures should be followed:-

1. *Issue prescription.* Doctor examines the patient and issue prescription for medication. The verification request is sent to the pharmacist for approval.
2. *Prescription verification.* Pharmacist receives, review and approve the verification request through online systems. Otherwise request is sent back to doctor for modification.
3. *Patient arrives at the payment counter*. Patient arrives at payment counter to get medicine after the issuance of the prescription by the doctor.
4. Check verified patient prescription. Upon arrival of the patient at the payment counter, the revenue collector checks in the system to determine if pharmacist has passed/verified the prescription.
5. *Issue payment request.* The revenue collector issues the payment request for passed/verified prescription.
6. *Make payment.* Patient makes payment and receives receipt for the medicines.
7. *Submit receipt.* Patient submits receipt to pharmacist for verification before issuing the medicine.
8. *Receive payment receipt.* Pharmacist receives the payment receipt before issuing medicine

9. *Prepare and issue medication.* The pharmacist prepares medicine as per doctor prescription and issue to patient. Give the patient right information on how to use the medication
10. *Receive medication.* Patient receives the medication and instructions from pharmacist.

2.3 Patient Billing Process

Hospital billing is a process to obtain payments for services and items rendered by the hospital. The hospital billing process begins when a patient arrives at the hospital for diagnosis and treatment of injury, illness, diseases, or any other health condition. Patient care services and items provided during the patient stay are recorded on the patients account. Charges are posted to patients account by various departments. When patient leaves the hospital, all information and charges are prepared for billing. Refer Figure 7 for further details.

Guidelines for process improvement

- For regional and zonal referral hospital payment for services can be done directly through the bank, as it is being done in some hospitals such as the Muhimbili National Hospital (MNH) and Mbeya regional Referral Hospital. For district hospital, payment methods such as MaxMalipo, Selcom can be considered.
- Standardize the claim forms for the credit companies.
- Enable electronic detection of the services covered and those that are not by the credit companies during patient care delivery.

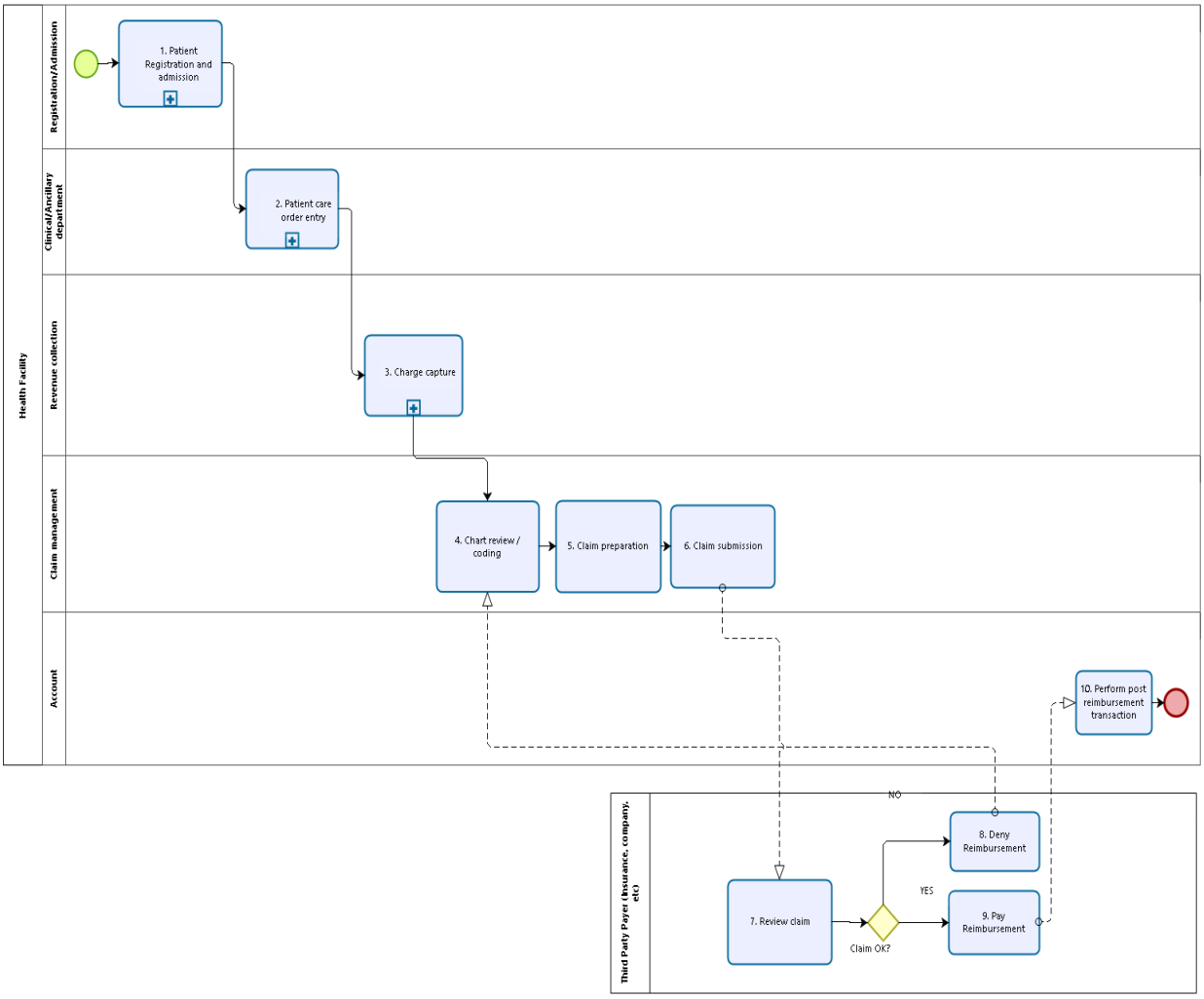

Figure 7: Patient Billing Process Map

Procedures for Patient Billing Process

To ensure services rendered in a health facility are properly charged to recover the incurred costs the following procedures should be followed:-

1. *Patient registration and admission*. Patient is received at the hospital in an outpatient or inpatient basis. Non-patient services may be provided when the specimen is received for processing and patient is not present.
2. *Patient care order entry*. Patient care services are rendered in accordance with physician's order. The physician's order are entered in hospital's information system and distributed to the appropriate department.
3. *Charge capture.* All services and items provided during patient's stay are documented in the patient's record. All departments, including pharmacy and sterile supplies, involved in providing patient care are responsible for posting charges to the patient's account.

4. *Chart review and coding.* The patient is released from the hospital when attending physician provides a written discharge orders and instructions. Once the patient is discharged the completed medical record, is forwarded for coding and review of patient's medical record to identify and verify charges.
5. *Charge/Claim preparation.* The claim management unit utilizes information gathered during the patient stay to prepare appropriate documents required for charge or claim submission. Patient invoice or statement is utilized to submit charges to the patient. Claim forms are utilized to submit charges to the third-party payer (i.e. Credit company such as NHIF, AAR etc.).
6. *Charge/Claim submission.* The claim management unit utilizes information gathered during the patent stay to prepare appropriate documents required for charge or claim submission. Patient invoice or statement is utilized to submit charges to the patient. Claim forms are utilized to submit charges to the third-party payer (i.e. Credit company).
7. *Bill payment.* Patient payments are posted and balance owed are printed on a statement and sent to the patient until the balance is paid. Claim received by payers (i.e. Credit company) is processed after review is performed. Payment determination is conducted by the payers after claim review is performed which can results in one of the following: claim may be paid, or pended, or denied.
8. *Post payment transaction.* Patient payments are posted and balance owed are printed on a statement and sent to the patient until the balance is paid. Claim received by payers (i.e. insurance) are processed after review is performed. Payment determination is conducted by the payers after claim review are performed which can results in one of the following: claim may be paid, or pended, or denied.

2.4 Account, Financial and Human Resource Management Processes

The back office processes in the hospital business process framework (figure 3.1) include accounts, finance, procurement and human resources management. These processes are guided by standardized procedures such as financial regulations and public procurement regulations. Improvement of the efficiency of these back office processes should be guided by the standardized procedures and regulations governed by their bodies such as Public Procurement Regulatory Authority (PPRA).

3 PART C: REQUIREMENTS AND STANDARDS

This part provides the minimum requirements and standards the iHMS must meet to ensure that it creates the value and the utility to its stakeholders. These requirements and standards have been drawn from the stakeholders, international literature and best practices. The requirements include both systems requirements, computing infrastructure and human resource requirements.

3.1 Systems Functional and Non-functional Requirements

This section covers the functional and non-functional requirements for the iHMS, which should be observed across the hospitals. The requirements are designed for multispecialty hospitals covering a wide range of clinical, administrative and management processes. The aim is to ensure an integrated end–to-end hospital management system that provides relevant information across the hospital to support effective decision making for patient care, hospital administration and critical financial accounting. However, it should be noted that implementation of iHMS requirements may entail to do hospital business process reengineering that involves a critical analysis and redesign of workflows and work practices of existing business processes within the hospital setting in order to maximum the value of the computerization process.

3.1.1 Functional Requirements

Description

Functional requirements capture the intended behavior of the iHMS expressed as services, tasks or functions the system is required to perform. MoSCoW (Must, Should, Could, Won't) technique has been employed to indicate the level of priority of each system requirement, where the minimum requirement that must be incorporated in each iHMS is indicated with a *must* priority.

Objective

To provide the minimum iHMS functional requirements to be followed by health facilities during implementation of a new iHMS or improvement of an existing system

Scope

The hospital functional areas covered in this guideline include patient care management, laboratory, billing, pharmacy and inventory, medical record management, human resource management, management information system (dashboard), and financial management.

1. Patient Care Management

Standards Guidelines

i. The iHMS shall provide functionalities that capture the complete and relevant patient information.

ii. The system shall automate the patient administration functions to give a better and efficient patient care process.

iii. The iHMS shall answer all enquiries about the patient, which include admission, appointment scheduling, billing and discharge details.

Table 1: Patient Care Management

Section	User/Functional Requirements	Priority
1.0	**GENERAL**	
1.1	The system should handle all the admission, transfer and discharge operations for the hospital. It should allow for a complete registration for a patient, or a quick registration for rapid registration at the Ambulatory & Emergency Department.	Must
1.2	System should generate a sequential Medical Record Number (MRN) for each new patient registration.	Must
1.3	MRN should be unique for each patient, and to be carried by the patient throughout the life of the hospital.	Must
1.4	System generated sequential Account Number should be generated for each new patient visit.	Must
1.5	Account Number should be unique for each visit, and should be used for all billing purposes.	Must
1.6	The system should have the ability to capture billing and insurance payment details to enable bills to be sent to correct payer.	Must
1.7	The system should have the ability to make certain fields mandatory during the registration process.	Should
2.0	**ADMISSIONS / REGISTRATIONS (A&E)**	
2.1	All admissions must be performed through a registration function (inpatient, outpatient, A&E).	Must
2.2	The system should have the ability to carry out a quick registration with minimal mandatory registration information process, e.g. for the A&E Department	Must
2.3	System should be able to flash alert to Registration Clerk if patient has any outstanding bills	Must
2.4	The system should have the ability to capture insurance and billing information at admission/registration time. These details will include whether the patient should be billed or not, Guarantee Letter information,	Must

Section	User/Functional Requirements	Priority
	Third Party Payer/ Insurance information etc.	
2.5	If billing is applicable, the system should automatically determine the consultation charges applicable based on the billing rules, to determine the applicable charge, and to enable the charges to be collected prior to the consultation.	Must
3.0	**NEW BORN ADMISSIONS**	
3.1	Newborn admissions must be based on mother-baby link, ie admission details to be based on mother's admission record.	Should
4.0	**BED BOARD MANAGEMENT**	
4.1	Online, real time bed availability status by Ward / Department hospital wide	Should
4.2	Ability to search for beds by ward	Must
4.3	Ability to search for beds by bed class, within the ward	Must
4.4	Ability to search for beds by bed class, throughout the hospital facility	Must
4.5	Ability to create dummy beds which can be used for admission when all beds in ward are occupied, but pending discharges. These beds are not to be included in the census count.	Should
5.0	**TRANSFERS**	
5.1	Can be effected between beds in the same ward or between wards	
5.2	System to chronologically sequence each transfer and keep track of patient's movement history.	Must
6.0	**DISCHARGES**	
6.1	Ability for system to check that all formalities have been completed and to trigger warnings otherwise.	Must
6.2	If a patient has to be billed (ie a patient without a Guarantee Letter), the system will check that a Discharge Bill has been generated, otherwise the discharge is not to be effected.	Must
7.0	**MASTER CODES**	
7.1	The system must have a provision to set Master Codes	Must
7.2	The sex of the patients to be admitted into the ward has to be coded, and the system will validate this during the admission process.	Must
7.3	Rooms within Wards : all rooms within the ward will be codified	Should
7.4	Beds for Wards : all beds within the ward will be codified, according to bed class	Should
7.5	Type of Ward : specifies classification of ward	Must
7.6	Bed Class : specifies classification of beds, and should be used to set up entitlements	Should
7.7	Admission Type : specifies the nature of admission	Must
7.8	Transfer Type : specifies the nature of transfer	Must
8.0	**QUERIES & REPORTS**	
8.2	Bed Occupation Inquiry: Ability to display on-line, the status of each bed in	Should

Section	User/Functional Requirements	Priority
	any ward, with details of patient occupying the bed.	
8.2	Hospital Bed Status Inquiry: Ability to display on-line, the total bed complement within the hospital with details of the number of beds occupied and free in each ward.	Must
8.3	Patient Movement History : Ability to display on-line the details of patient Admission Discharge and Transfer for each patient	Must
8.4	Inpatient lists : Reports of all inpatients in all wards, sorted by ward, by admission date, by admitting doctor, by patient name, by sex etc.	Must
8.5	List of Admissions : Reports on all patients admitted, with full admission details, sorted by Admission Date, Ward, Admitting Doctor	Must
8.6	Admission Discharge and Transfer statistics such as Admissions by admission types, Admissions by medical specialty, Transfers by transfer type, Discharges by discharge type	Should
9.0	**BED CHARGES**	
9.1	Calculation of bed charges based on number of days stayed	Must
9.2	Calculation of bed charges based on financial class of patient	Should
9.3	Calculation of bed charges based on bed type	Should
9.4	Automatic calculation of bed charge if the bed is occupied for more than a pre-defined number of days	Should

2. Laboratory

Standard Guidelines

i. The iHMS shall automate the investigation request and the process involved in delivering the results to the concerned department/doctor of the hospital.

ii. The system shall start by receiving online requests from doctors and also allow laboratory personnel to generate requests.

iii. The iHMS shall support performance of various tests under the following disciplines: Biochemistry, Cytology, Hematology, Microbiology, and Serology.

iv. Laboratory tests shall be grouped under various sections and sample type (specimen). Based on the request the user can input the sample and generate the sample number. Results can be entered based on the sample type either to one test or multiple tests.

v. If the test result requires approval, the supervisor shall approve the result and make it available to concerned doctors.

Table 2: Laboratory

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	The system will be used in the AP Section of the Main Laboratory, serving the needs of the Inpatients, Outpatients, Emergency Departments, and	Must

Section	Functional Description	Priority
	Operating Theaters.	
2.0	**CHARGING**	
2.1	To create a charge in the patient's bill for any procedure that is carried out.	Must
2.2	There should be flexibility to determine at which point the patient will be charged for the procedure. For example, for Test A, the patient could be charged at the point the test is ordered, while he could be charged only when the procedure has been reported for Test B, or when the procedure has been completed for Test C.	Should
2.3	There will be an option for a supervisor to reverse a charge if required.	Must
3.0	**QUERIES AND REPORTS**	
3.1	Inquiries by Patient name or MRN, Accession number, Physician, Source (ward / clinic / department), Test Charges collected department wise lab wise.	Must
3.2	There must be an option for supervisor to reverse a charge if required	Must

2.1 Laboratory Order Management

The Order Management application addresses the order entry, order review and/or validation

Table 3: Laboratory Order Management

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	The Order Management application addresses the order entry, order review and/or validation, It is envisioned that orders can be placed for any ancillary department by any user in the hospital, depending on the security level assigned to him	Must
2.0	**ORDER ENTRY**	
2.1	The order entry process can be decentralized, ie an order can be placed from any PC within the hospital.	Must
2.2	The system will be able to handle the following order types : single order, multi-departmental orders.	Should
2.3	Users should be able to place any type of order, clinical or non-clinical, from one application.	Must
2.4	Each order type must have its own set of pre-determined data fields.	Must
2.5	There is an option to identify the urgency of an order.	Should
2.6	There is an option to cancel or modify an order if it has not been processed yet.	Should
3.0	**ORDER PROCESSING**	
3.1	The status of any order will be updated automatically, real-time, by the system to enable users to have an online review of the status of any order for any patient.	Must

Section	Functional Description	Priority
4.0	**ORDER INQUIRY**	
4.1	Users can review the status of any order online from anywhere within the hospital.	Should
4.2	Users restricted to viewing information only on those patients in their assigned locations.	Must
6.0	**CHARGING**	
6.1	The system creates a charge in the patient's bill for any procedure that is carried out.	Must
6.2	There will be flexibility to determine at which point the patient will be charged for the procedure. For example, for Test A, the patient could be charged at the point the test is ordered, while he could be charged only when the procedure has been reported for Test B, or when the procedure has been completed for Test C.	Must
7.0	**QUERIES AND REPORTS**	
7.1	On-line status inquiry of requests	Must
7.2	On-line charges inquiry	must

3. Operation Theatre Management

Standard Guidelines

i. The iHMS shall have a component to provide all functions required for managing and charging operating theatres services of the hospitals.

ii. The system component shall be able to automatically create a charge in the patient's bill for any procedure that is carried out.

iii. It shall provide easily accessible and immediate reports on surgeries not yet charged, surgeries completed not yet charged, etc.

Table 4: Operation Theatre Management

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	The Operating Theatre (OT) Management application will provide all functions required for charging of the Operating Theatres of the hospitals.	Must
2.0	**CHARGING**	
2.1	There will be an option for users to charge by exception.	Must
2.2	The system automatically creates a charge in the patient's bill for any procedure that is carried out.	Should
2.3	There will be an option for a supervisor to reverse a charge if required.	should
3.0	**QUERIES AND REPORTS**	
3.1	Exception Reports for the following:	
3.1.1	Surgeries not yet Charged	Must

Section	Functional Description	Priority
3.1.2	Surgeries completed but charging not done.	Must

4. Billing

Standard Guidelines

i. The system shall provide functionalities related to billing the patient for all the services taken in the hospital.

ii. Patients/clients shall be billed according to business rules of the hospital, which should be maintained and validated by the system.

Table 5: Billing

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	The system must provide the hospital with a comprehensive facility to track all charges for a patient from the point of registration to the stage of discharge / completion of a visit.	Must
1.2	The billing process must be flexible so that it can be done for inpatients at pre-defined periods or at end of the episode, while for outpatients it can be done at each service point (either at the point the order is placed or at the point it is completed), or at the end of the visit.	Must
1.3	This system must be fully integrated system so that billing transactions can be automatically posted to the patient's account from the laboratory, radiology, operation theatres, pharmacy, wards/clinics and so on.	Must
1.4	Patient Billing must also be integrated with Accounts Receivable for managing credit patients.	Must
1.5	The benefits envisaged through the implementation of an integrated or tightly interfaced Patient Billing System include Automatic, real-time build-up of patient's service charge profile. Billing can be done at short notice Instantaneous availability of patient-dues, various service charges etc. Enables analysis of the hospital's income through various services. Saves the Accounts department a lot of time and effort that would otherwise be spent on tracking patient charges. Facilitates effective control and monitoring of receivables.	Must
2.0	**BILLING GROUPS**	
2.1	The system must be able to classify patients into various Billing Groups in order to group patients into various paying categories.	Must
2.2	The system must be able to capture various paying categories including but not limited to non-paying / individuals paying cash / individuals with credit facility /	Must

Section	Functional Description	Priority
	sponsored patients (sponsored by insurance company, employer etc.) with credit facility.	
3.0	**BILLING CLASSES**	
3.1	System must be able to allow users to define various classes of service rendered in user-defined terms as say, first class single bed / first class double bed/ second class bed / ordinary class bed / etc	Must
3.2	Billing classes will be determined and entered into the system at registration time.	Must
4.0	**BED CHARGES**	
4.1	The system should provide flexibility in defining bed charges depending on the type of ward / room / bed	Should
4.2	If the patient occupies beds of differing classes on the same day, the bed, which has the higher daily bed charge, will be selected for billing.	Should
5.0	**BILLS**	
5.1	System must have flexibility to print inpatient bills periodically for all inpatients or individually at the end of the inpatient episode.	Must
5.2	The system must have flexibility to print interim bills for inpatients	Must
5.3	The system must have flexibility to print outpatient bills at each service point, at the point that the service is provided or consolidated at the end of the outpatient visit.	Must
5.4	The system must be able to automatically calculate all relevant government service taxes and add it to the bill.	Must
6.0	**CASHIERING FUNCTIONS**	
6.1	There must be provision to identify the Cashier Counter during cashier operations to ensure accountability of all transactions processed. This will also record the cashier identifications such as his user id, which is unique within the system.	Must
6.2	The system must have facility to process various kinds of receipts, for example, Collection against a bill, Collection against an account receivable for patients with credit facility, Collection of a deposit, Collection of a pre-payment, etc.	Must
6.3	The system must have facility to process various kinds of refunds, for example, Refund against a bill, Refund of a deposit etc.	Must
6.4	Ability to print receipts / refund documents on pre-printed stationery in on-line mode or batch mode	Must
6.5	All receipts and refund documents must be customizable by the users	Must
6.6	System must support various types of receipt printing based on visit type, for	Must

Section	Functional Description	Priority
	example, a different receipt is required for an emergency visit as compared to an Outpatient visit or Inpatient visit.	
6.7	Receipts must have system generated sequential numbers, the format of which will be user-defined.	Must
7.0	**QUERIES AND REPORTS**	
7.1	Inquiry on Patient Details	Must
7.2	Inquiry on Patient Charge Profile	Must
7.3	Inquiry on account status	Must
7.4	List of Receipts	Must
7.5	List of Third Party Payer Bills, to be printed on a pre-defined schedule	Must
7.6	List of discharges to reconcile with bills	Must
7.7	Inpatient bills in detail as well as summary	Must
7.8	Inquiry on patient financial details by Patient name Account number	Must
7.9	Inquiry on any transactions recorded In an account	Must
7.10	Inquiry in patient's current charges and outstanding status	Must
7.11	Top up reports for patients whose current charges have exceeded the deposit paid	Must

5. Pharmacy and Inventory Management

Standard Guidelines

i. The iHMS shall provide functionalities for requisition of medical supplies, purchase of items, issuance of items, stock management, automatic reorder level setting, online request for stock from main store to various sub-stores and dispensing points, management of stock at different categories such as physical stock verification and adjustment, return of medical supplies to supplier.

ii. The system shall be able to receive prescriptions from the consulting doctors and reflect automatically into dispensing unit and payment counter of a respective patient.

Table 6: Pharmacy and Inventory Management – A

Section	User/Functional Requirements	Priority
	STOCK CONTROL	
1.1	The pharmacist may set the stock levels required by the hospital to maintain one or more pharmacy outlets within the hospital.	Must
1.2	The stocks can be replenished by a process or manually triggered by the person responsible.	Must
1.3	Automatically generate reorder documents for the procurement of new stock.	Must

Section	User/Functional Requirements	Priority
1.4	The system will also facilitate manual entry of requisitions from the various wards/clinics/departments in the hospital.	Must
1.5	Expiry and non-expiry items must be supported. For expiry items stock is maintained at batch level with expiry date for each batch; and any store transaction must identify the batches being processed as part of the transaction.	Must
1.6	Facility to maintain preparation details and constituent items for manufacturing items. Manufacturing receipts use this information to receive the prepared item into stock and reduce stock from the constituents that have been used. Plus minus variation limits can be set on usage of constituents.	Must
1.7	Facility to record transfers between main stores, sub stores and despising points.	Must
1.8	Stock balance must be updated immediately on confirming a transaction (receipt of stock into inventory, returns to vendors, dispensing to patients) to reflect true on-hand status at any time.	Must
1.9	Automatic validation and warning on expiry of items.	Must
1.10	Provision to remove expired items from active stock to be replaced or destroyed.	Must
1.11	Provision for recording physical stock check figures and generating variance reports and automatic adjustments. There must be a facility to use hand held devices for stock checks where inventory information can be downloaded to the device at the start of the stock take, and then uploaded back into the main system at the end of the day.	Must
1.12	Mandatory entry of reason in adjustments for audit purposes.	Must
1.13	Stock transactions effect on financial accounts need to be reflected in the General Ledger based on the accounting linkages.	Must
1.14	Provision to close each accounting month after all transactions have been recorded for that month.	Must
1.15	Outgoing medicines and prescriptions are automatically deducted from its stock list.	Must
1.16	For each item-store combination, the minimum/maximum quantities and re-order quantities are maintained depending on the policies and procedures adopted for replenishment of stock at the sub-stores and non-stock stores.	Must
1.17	As the inventory levels reach reorder points, the system will automatically generate purchase orders for reordering by comparing the stock-on-hand with the reorder level. The orders must be reconciled upon delivery.	Must

Section	User/Functional Requirements	Priority
2.0	**MEDICATION ORDERS**	
2.1	Medication orders can be entered for inpatients who are identified by their financial numbers so that medications can be connected to each term of stay separately.	Must
2.2	The drug item codes will be easily and quickly retrieved by mnemonic, trade or generic name search.	Must
2.3	The system will allow order entry in centralized or decentralized locations throughout the hospital, by various categories of staff such as physicians, nurses, clerks or technicians.	Must
2.4	Pharmacist verification, if required, will be quickly and efficiently entered or modified for conditional medication orders. Clinical alert warnings may be delayed until the pharmacist verification step or may appear during non-pharmacist order entry. In all cases, clinical warnings, including user actions, must be recorded for action and review at a later time.	Must
2.5	Master Codes – the following Master Codes must be set up within the system :	
2.5.1	Drug Forms: Code and description for the various forms in which drugs are Available.	Must
2.5.2	Route of Administration: Code and description for the different methods in which a drug can be administered, e.g. Intravenous, Oral.	Must
2.5.3	Instructions for Administration: Code and description for brief instructions on the method of administering a drug to patients.	Must
2.6	The system must enable users to enter all medications into the system from the same screen. Medications can be selected by mnemonic, brand name, generic name, therapeutic category, or product codes.	Must
2.7	Common order entry sets should be defined to further expedite the order entry process by having the most commonly used items pre-selected for activation and the less customary items Available for activation.	Must
2.8	If there have been medication orders earlier for the same inpatient, then medications issued to the patient must be checked for inclusion of these drugs and warnings issued where appropriate	Must
2.9	For controlled drugs, a supervisor must authorize the issue before the transaction can be processed.	Must
2.10	The system must have provision for returns against prescriptions	Must
2.11	The system must provide support for all medication orders, processing, administration, and dispensing in a paperless environment.	Must
3.0	**QUERIES AND REPORTS**	

Section	User/Functional Requirements	Priority
3.1	Drug formulary inquiry by code, trade name and generic name.	
3.2	Inquiry on drug interactions.	Must
3.3	Inquiry on patient's total drug profile (all medications and prescriptions to date).	Must
3.4	List of inpatient medication orders by patient, ward and doctor.	Must
3.5	Details listed will include the financial number and MRN of the patient, patient name, prescription number and date, drug code and name, start date for the medication, period, dosage, doctor's identity, quantity of the drug prescribed and whether the order is a one-time or repeating prescription.	Must
3.6	List of outpatient prescriptions by patient, clinic and doctor.	Must
3.6.1	List of Repeating Orders for a given drug store/pharmacy and for a specified range of dates.	Must
3.7	Controlled drug register	Must
3.8	List of discontinued drugs	Must
3.9	Stock status report	Must
3.10	Stock ledger	Must
3.11	Stock Analysis reports on fast moving items, slow moving items and non-moving items.	Must
3.12	Consumption statement by item and by ward/clinic/department.	Must
3.13	Valuation statements by costing units	Must
3.14	Expiration list by period	Must
3.15	Items to be re-ordered	Must
3.16	Items above maximum stock levels	Must
3.17	Daily transaction details report	Must
3.18	On-line stock status inquiry by item for all stores in the hospital and by store for all items in that store.	Must
3.19	Inquiry on stock transactions for an item.	Must

6. Finance and Accounts Management

Table 7: Pharmacy and Inventory Management – B

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	The system must be able to handle on-line data entry	Must
2.0	**VENDOR INFORMATION**	
2.1	Vendor codes should be alphanumeric.	Should
2.2	The vendor code should be either system generated or manually entered.	Should
2.3	A short name, mnemonic or vendor codes will be used to access vendors	Should

Section	Functional Description	Priority
	during transaction entry and enquiries.	
2.4	The system should cater for the following information on the vendor record:	
	Vendor code, vendor short name, vendor name, vendor address, vendor telephone, vendor facsimile number, vendor contact person, vendor type, optional bank details, optional or user-defined multiple credit terms or contract information, currency details, payment method, credit limit, last date of activity, lead time, history, GL codes for purchases, creditors and cash	Should
2.5	The system should produce a list of vendors with no activity for a specified period of time.	Should
3.0	**VOUCHER ENTRY**	
3.1	The system should provide:	
	invoice register facilities	Must
	certification of invoice values	Must
3.2	The system should register and certify the invoice at the same time.	Must
3.3	The system should record to whom invoices have been sent for either approval, GL coding or adjustment.	Must
3.4	The system should allow for the following fields in the transaction record: vendor code, vendor reference invoice number, transaction reference for internal use, invoice type, terms, invoice date, invoice receipt date, posting date, due date, period, gross amount, discount, net amount, optional quantity , optional unit price , transaction currency, currency rates, payment method e.g. cheque, bank details, order number and link to order details e.g.. item code, type, order quantity, GL code, hold information - before updating GL, status code - delivered or not, flag prepaid for items	Must
3.5	The system must check for duplicate vendor invoice numbers.	Must
3.6	There is no limit to the number of lines per invoice.	Should
3.7	General ledger code distributions should be entered on: purchase orders, vendor record, individual lines on an invoice	Must
3.8	General ledger distribution codes should be validated online in the AP and invalid transactions rejected.	Must
3.9	The system must check that the total recorded against the distribution lines equals the total invoice sum.	Must
3.10	The system should be able to handle discounts as either a percentage or an amount.	Should
3.11	The system should automatically post a discount to the correct general ledger account for discounts.	Should
3.12	It should be possible for a group of invoices to be authorized for payment	Should

Section	Functional Description	Priority
	together.	
3.13	Matching should be available for both the whole invoice and line by line	Should
3.14	It should be possible to process and authorize a goods received note.	Should
315	A credit note can be matched with parts of one invoice	Should
3.16	Amount transactions entered on-line can be posted at the end of the day or period.	Should
3.17	Posting should update the accounts payable, general ledger	Should
4.0	**PROCESSING OPTIONS**	
4.1	The system should allow processing of more than one accounting period typically previous and future periods.	Should
4.2	The system should handle accruals with automatic reversal in the next period.	Should
4.3	The system accept open item accounting.	Should
4.4	It should be possible to search using: supplier name, supplier short name, invoice number, invoice reference, purchase order number, cheque number, transaction date	Should
5.0	PAYMENTS	
5.1	It should be possible to process manual cheques and they should appear on the cheque register.	Should
5.2	It should be possible to pay more than one cheque for a vendor.	Should
5.3	It should be possible to stop payment of a specific invoice temporarily.	Should
5.4	It should be possible to make a payment during the same processing cycle that the invoice was entered.	Should
5.5	It should be possible to pay invoices as specified without regard to the payment scheduled date.	Should
5.6	The system should allow for part payments to be made.	Should
5.7	It should be possible for individual items to be paid on the next payment date to be listed in advance of the cheque processing cycle.	Should
5.8	Duplicate payments should be identified.	Should
5.9	Individual general ledger codes should be specified for each bank account.	Should
5.10	The system should be able to handle advance payments.	Should
5.11	The interface with the general ledger should allow the cheque number reference to be passed into the general ledger to assist with bank reconciliations.	Should
5.12	If a posted payment is voided, the GL posting should automatically be reversed.	Should
5.0	**PURCHASE ORDER PROCESSING**	
6.1	The system should facilitate matching, of purchase orders, receiving reports and vendor invoices.	Should

Section	Functional Description	Priority
6.2	Matching should be available for both the whole invoice and manual matching.	Should
6.3	The system should produce exception reports of unmatched invoices.	Should
7.0	**INTERFACES**	
7.1	The user should have the option to post to the general ledger: at the detail level and summary level by voucher	Should
7.2	The general ledger should be posted at the same time as the accounts payable subsidiary ledger is posted.	Should
7.3	The system should support interfaces to other systems including: purchasing, receiving, general ledger, stock control	Should
8.0	**VENDOR PURCHASE ANALYSIS (REPORTS)**	
8.1	There should be a report summarizing purchase and payment history by vendor.	Should
8.2	There should be a report listing open items and paid items.	Should
8.3	The system should print vendor statements.	Should
8.4	The system should produce a vendor ledger listing by vendor number and alphabetically	Should
8.5	The system should be able to produce an accounts payable invoice/voucher register.	Should
8.6	The system should produce an aged outstanding balance report by vendor in both detail and summary.	Should
8.9	Aging bands (e.g.. 30,60, 90 days) should be user-specified.	Should
9.0	Queries	Should
9.1	On-line enquiry capabilities should exist to report: all open invoices per vendor, vendor payments activity standard terms, vendor purchase activity: - this period - previous periods - previous years payments matched to specific invoices, transactions with different status indicators	Should
9.2	The system should perform on-line sorted enquiries whereby all vendor information is presented at the user's option: in posting date sequence, in voucher number sequence, in due date sequence, in payment status sequence	Should

7. Medical Record Management

Standard Guidelines

i. The iHMS shall be able to maintain the core information on clinical care. A complete standard International Classification Diagnosis (ICD) 10 should be used to build up the data for medical records. It should be possible to maintain diagnosis, treatment advised and surgery/treatment details in the record.
ii. The system shall provide two levels of medical records: One should have the basic data and the other level should have the detailed records of surgery, and diagnosis.
iii. As part of the medical records, the iHMS shall be able to store image outputs from used equipment.

Table 8: Medical Record Management

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	Superior GUI to make data collection easier for the consulting doctors/transcriptionists	Must
1.2	Collated and formatted of information on patients, as required	Must
1.3	Search on patient records by patient names, patient ID, etc.	Must
1.4	Complete clinical data repository	Must
1.5	Capturing basic patient demographic details	Must
1.6	ICD-10 codes for diagnosis and clinical findings	Must
1.7	Rea time ordering of tests and medications	Must

8. Human Resource Management

Standard Guidelines

i. The iHMS shall track and manage all the human resourcing activities with respect to the Personal and Payroll functions.
ii. The system shall provide functionality related to employee management, directory management, leave management, and roaster management.
iii. The iHMS shall be possible for the system to be integrated with biometric solutions to identify employees as they arrive and leave the hospital premises.

Table 9: Human Resource Management

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	The system should perform and manage daily attendance entry using biometrics	Must
1.2	Leave accounting and management	Must
1.3	Pay slips management	Should
1.4	Produce payroll reports	Should

Section	Functional Description	Priority
1.5	The system should be able to be integrated with biometric solutions	Should

9. Management Information System

Standard Guidelines

i. The iHMS should provide managers with a dashboard that offers real time, at-a-glance personalized information related to various activities.

ii. The system shall be able to dig deep in the system and come up with real-time reports to support immediate decision making.

Table 10: Management Information System –Dashboard

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	Revenue profile doctor wise	Must
1.2	Revenue profile department wise	Must
1.3	Revenue profile procedure / package wise	Must
1.4	Expense profile doctor wise	Must
1.5	Expense profile department wise	Must
1.6	Expense profile procedure / package wise	Must
1.7	Treatment profile and collection profile	Must
1.8	Exception report on deviation from set of parameters for Purchase, discounts, collections, credits	Should
1.9	Patient registration statistics	Must
1.10	Patient admission statistics by date, ward and consultant	Must
1.11	Patient discharge statistics by date, ward and consultant	Must
1.12	Bed occupancy statistics by date and ward, by doctor	Must
1.13	Outpatient visit statistics by date and clinic	Must
1.14	Contribution Statement	Must

10. Financial Management

Standard Guidelines

i. The iHMS shall cater for the entire range of accounting activities that is conducted in a typical hospital setting.

ii. Right from when patient walks in to the time the hospital presents its profit and loss accounts, the iHMS shall be able to manage and provide information from every transactional point of hospital like pharmacy, canteen, blood bank, over time, maintenance.

Table 11: Financial Management

Section	Functional Description	Priority
1.0	**GENERAL**	
1.1	All transaction vouchers generated in the system are collated and they are posted on daily basis or online onto the system	Must
1.2	Cash/Credit/Bank Transaction	Must
1.3	Daily Cash Book	Must
1.4	Daily Bank Book	Must
1.5	Account Receivable Statement with Ageing Analysis	Must
1.6	Income & Expense profile department wise / Budget wise	Must
1.7	Supplier Ledger	Must
1.8	General Ledger	Must
1.9	Trial Balance	Must
1.10	P & L	Must
1.11	Balance Sheet	Must
1.12	Expenditure Analysis	Must
1.13	Exception Analysis	Must

3.1.2 Non-Functional Requirements

Description

Non-functional requirements define the overall qualities or attributes of the resulting system that place restrictions or conditions on the system being developed, the development process, and specify external constraints that the system must meet. The non-functional requirements usually impact many parts of the system, and they may be related to one or many features e.g. How long can the system be down and how easy should it be to restart it, or if data becomes corrupt how does a user fix it and which users can do so? Taking into consideration the intricacies of hospital setting, involving precarious situations of serving lives, ensuring that the iHMS adhere to a minimum set of non-functional attributes is indispensable.

Objectives

To ensure that the iHMS adhere to a minimum set of non-functional attributes for improved clinical and administrative service provision at the health facility.

Scope

The non-functional requirements covered in this guide revolve around the factors that ensure proper functioning of the iHMS such as usability, usefulness, etc. and its surrounding environment.

Standard Guidelines

The iHMS system should meet the following non-functional quality attributes:

1. **Usability**
   i. The system should provide interactive touch screen interface for ease and fast access
   ii. The average user learning time must be less than 1 day
   iii. The system should help users to avoid doing mistakes
   iv. The system should provide screen, mouse and keyboard navigation.
   v. The system should be easy to navigate by using clear words, menus and drop-down lists.
   vi. The system should be accompanied with a user manual.
2. **Access Security**
   i. All patient data should be encrypted to ensure confidentiality of patient data,
   ii. The system should be able to limit the availability of individual identifiable information only to authorized users at a facility level.
   iii. The system should reveal private information only in compliance with the health information policy
   iv. The system should encrypt transmission of data across open and public networks
   v. The system should provide strong passwords that contain a minimum of seven (8) alpha/numeric characters for standard user accounts.
   vi. The system should provide analysis of audit trails and unauthorized access attempts
3. **Availability**
   i. The system should be available for 24 hours per day, 365 days per year
   ii. Data upload operations should be resumed when a connection interruption occurs.
   iii. The system must achieve 99 percent uptime.
   iv. Users should be notified when the system is not available
   v. The system should cater for 50 concurrent users within the period from 9:00 A.M. to 5:00 P.M. Maximum loading at other periods should be 100 simultaneous users.
4. **Efficiency**
   i. iHMS will be essential and extensively used system in the hospital and; it is expected that many users/systems will interact heavily with the back-end databases. To make such interactions possible and make them efficient and fast, the design of iHMS (i.e. iHMS architecture) and deployment architecture should take into consideration of the efficiency.
   ii. The system must process 1260, 875, 470 transactions per day for zonal, regional and district hospitals respectively.
   iii. The system must be capable to cater for 40, 80, 150 concurrent users for district, regional and zonal hospitals respectively.
5. **Integrity**
   i. The transaction history should be maintained in the systems for rolling 90-days

ii. The system should retain partial data from interrupted entry for 15 minutes

6. Reliability

i. iHMS system should be available 24 hours a day for application users

7. Scalability

ii. The system must be capable to scale from the original concurrent users to accommodate an increase of at least 50% additional users. The current estimate number of concurrent users is 40, 80,150 for district, regional and zonal hospitals respectively.

iii. The system must be capable to scale from the original transactions to accommodate an increase of at least 50% additional transactions. The current estimate of transactions is 1260,875, 470 per day for zonal, regional and district hospitals respectively. iHMS System Architecture and Information Exchange

3.2 Standards and Information Exchange

Description

It is required that the iHMS be able to share and exchange information with other systems in the health sector. This is important because of several reasons, increased efficiency through decreasing entry of duplicate data, decreased errors in medical information through the same mechanism, increased availability of health information promoting better decision making, and improved continuity of patient care. The integration and information sharing between health systems requires systems be interoperable. The interoperability is achieved through standardization process that requires the creation, acceptance and implementation of clinical data standards to ensure that data in one system are available and meaningful in another system. The selection of iHMS data, coding and interoperability standards has been guided by the following principles:

- Open non-proprietary standards will be given preference over proprietary ones.
- International standards which have been implemented and validated will be preferred.
- Development of a new standard will only be considered as a last resort when there is no international standard available
- The standards proposed will ensure value for money and minimize cost of compliance

Objectives

To identify the minimum set of standards required for implementing iHMS. The standards have been drawn from international standards.

Scope

The scope of the iHMS standards covers data exchange, coding standards to enable interoperability and data sharing

Standard Guidelines

1. **iHMS shall support Data exchange (or messaging) standards**

i. The iHMS must have the capability to transmit and receive a defined minimum set of patient data via standardized HL7 messaging. Health Level 7 (HL7)[1] is a flexible standard by which various health care systems can communicate with each other; it is typically used for transmission of patient level data.

ii. By using the HL7 the iHMS shall be able to exchange of information, data standards have to be developed to ensure consistency of both structure and meaning of data between information systems. Standard formats require agreement both on format (syntax) and meaning (semantics). Format is the order and structure of specific data fields, while meaning is expressed through the choice of coding schemes, rules, and other constraints on content.

2. **iHMS shall support coding standards**

i. The iHMS system should be able to build up the data for medical records using standard the International Classification of Diseases (ICD) version 10. International Classification of Diseases [2](ICD) is a statistical classification system used to assign diagnostic and procedural codes in order to produce coded data for statistical analysis, epidemiology, reimbursement and resource allocation.

3. **iHMS shall support interoperability standards**

For information sharing between different systems to occur it requires data exchange standards for packaging and transmitting the data.

i. The iHMS shall be able to share data with other systems such as DHIS2, HRHIS, PACS, financial systems etc. using data exchange standards /communication interfaces e.g. Application Programming Interfaces (APIs) developed based on different technologies such as JSON, XML, DXML etc.

ii. The system shall also be able to interface seamlessly with third party diagnostic devices such as digital X-Rays, MRIs etc.

Responsibilities

Responsible Person/Team	**Roles**
iHMS Implementation Team & Steering Committee	1. Ensure the iHMS software supports the HL7 messaging standard and the ICD 10 coding

[1]Health Level 7(HL7),http://www.hl7.org/implement/standards/

[2] ICD 10, http://www.who.int/classifications/icd/en/

	standard 2. Ensure that the iHMS support data sharing through data exchange standards such as APIs developed using different technologies such as JSON, XML, DXML

3.3 Infrastructure and Human Resource Requirements

Deployment and implementation of the iHMS requires adequate and reliable computing infrastructure and human resource necessary to provide both technical and manage the operation of the iHMS from inception to operations.

3.3.1 Computing Infrastructure Requirements

Description

For successful iHMS deployment and implementation in any health facility, adequate and reliable computing infrastructure is indispensable. This section puts forth the minimum computing infrastructure requirements necessary to support deployment and sustainable use of iHMS in a district, regional, and zonal referral hospitals or in any multispecialty private or faith based hospitals.

Objective

To provide the minimum computing infrastructure requirements necessary to support the hosting of iHMS applications and provide communication and system platforms for users to access and use the system.

Scope

The minimum computing infrastructure requirements covered include the data center, network and Internet connectivity, workstations, and computer training laboratory.

Standard Guidelines

1. **Health facilities shall have a data center or sever room**

In order to implement iHMS, a hospital should allocate a spacious, user and environmental friendly room for housing ICT infrastructure and systems. The data center should meet the following minimum requirements:

i. The room must have reliable primary and backup power supply. Backup power supply solutions may include uninterrupted power supply (UPS), Inverter with battery bank,

generator or solar power system enough to power all servers and network devices for at least 8 hours (preferably 12 hrs.)

ii. The room must have proper security including physical access controls and all visits to the room must be recorded. Logbook or an automatic access control system should be registering all visits to the server room/ Data Center.

iii. The room must be temperature controlled with air conditioner and well furnished. Furthermore, the room must be free from dust, water leaks and humidity.

iv. The servers should be rack mountable servers installed in lockable rack cabinets, together with required backup storage.

v. The room have fire extinguishers and fire detection systems (alarms)

2. **Network infrastructure shall be in place to support iHMS**

Network infrastructure refers to the hardware and software resources of an entire network that enable network connectivity, communication, operations and management of a hospital network. It includes local area network, wide area networks and Internet connectivity. The network and internet connectivity should meet the following requirements:

i. Network drawings should be well updated and available at all times for reference.

ii. Local area network (LAN) should have well structured cabling and well labeled considering quality cabling design. The design should separate access network from the backbone network that connects buildings.

iii. The Wide Area Network (WAN) / Internet connectivity should have the required speed capable of supporting the business requirements. Depending on the deployment architecture used, a backup or redundant connection is required.

3. **There shall be computer workstations/terminals for end users**

For end users to be able to use the iHMS, the need for computers and other computing devices in various service points in the hospital is indispensable. The minimum requirements for computers and other computing devices are detailed in Table 13.

4. **Health Facilities shall have computer training room**

Each hospital requires a dedicated computer training room to be used for user training, learning and system testing. The requirements and specification for the computer lab varies depending on facility size, number of staff, organizational settings and specific needs.

Table 12 provides the minimum set of computing infrastructures. However, before iHMS implementation at any hospital, assessment to validate actual requirements based on these minimum requirements should be done, and inventory list should be well maintained.

Table 12: Recommended Computing Infrastructure for District, Regional and Zonal Hospitals

	District	Regional	Zonal
Data Center/Server Room			
Servers	2	2	2
Software (OS, DB system, utilities)	2	2	2
Routers/Firewall	1	1	1
Network switches	1	2	2
Data cabinet	1	1	1
Power distribution Units (PDUs)	1	1	1
Cooling system	1	2	2
Network and power cabling accessories	Various	Various	Various
Fire detectors and extinguishers	1	1	1
CCTV system with 3 cameras, DVR	1	1	1
Computer Room			
Desktop computers	10	20	30
Laptop computers	1	1	1
Software (OS, utilities)	11	21	31
Tables	11	21	31
Chairs	11	21	31
Projectors	1	2	2
Projection Screen	1	2	2
Power distribution Units (PDUs)	1	2	2
Network switches	1	1	1
Data cabinets	1	1	1
Cooling system	1	1	2
Network and power cabling accessories	Various	Various	Various
Renovation (e.g. painting, wiring, ceiling, floor)	Various	Various	Various
Network and Internet Connectivity			
LAN Switch 48ports	1	1	5
LAN Switch 24ports	0	3	12
LAN Switch 16 ports	6	10	20
Data cabinets	3	3	5
Power distribution Units (PDUs)	4	3	5
Network and power cabling accessories	Various	Various	Various
Workstations			
Desktop computers	34	35	93
Software (OS, utilities)	34	35	93
Tables	34	35	93

Chairs	34	35	93
Power distribution Units (PDUs)	34	35	93
Printers	18	18	42

3.3.2 Human Resource Requirements

Description

The successful iHMS implementation requires right people at the right time both within and outside the hospital. This section presents the minimum recommended competencies and roles for key players in the system implementation and operational process required for a success implementation and management of the iHMS. However the human requirements analysis will be reviewed when implementation approach has been selected for example iHMS operations may adopt a data clerk centered approach (retrospective data entry) or a clinician centered data entry approach (point of care systems). Both approaches will have different human resource requirements in terms of numbers and skills required.

Objectives

To provide the minimum recommended competencies and key role players required for a successful implementation, operationalization and management of the iHMS.

Scope

The minimum human resource competencies and key role players requirements covered include systems analyst, systems/network administrator, ICT support technician, and data/medical records clerks. These minimum requirements focus on different levels of hospitals both public and private.

Standard Guidelines

1. System Analyst

A system analyst shall be responsible for a variety of technical duties involved in planning, installing, maintaining, testing, and management of the hospital's computerized information systems. The analyst shall also be responsible for identifying business requirements and translate the requirements into systems requirements for implementation. The minimum numbers of systems analysts required in each category of health facility is stipulated in Table 14.

2. System/Network Administrator

The system/network administrator shall be responsible for the upkeep, configuration, and maintenance of hardware and computer systems that make up a hospital-computing infrastructure including the maintenance and monitoring of active data network, servers and

related network equipment. See the minimum requirements for system/network administrator in Table 14.

3. ICT technician

Information and communication technology (ICT) technician shall be responsible to provide assistance to end users on the use of computer systems by answering questions, resolving technical problems and maintaining a hospital's network, software and computer equipment. They are also called desktop support technicians or computer support specialists. They are first line support on all issues related to ICT and the systems at large, including the iHMS. The minimum number required is presented in Table 14.

4. Data/Medical Record Clerks

A data entry clerk shall be responsible for entering or updating data into a computer system, often from paper documents using a keyboard, optical scanner, or data recorder. Data or medical record clerks should be conversant with medical coding and data entry. Table 13 provides the recommended staffing level for data.

It should be noted that, before implementation at any hospital, assessment to validate actual requirements based on these minimum requirements should be done.

Table 13: Recommended ICT Staffing

S/N	JOB TITLE	ZONAL	REGIONAL	DISTRICT
1	System Analyst	3	2	1
2	System/Network Administrator	4	2	1
3	ICT Support Technician	8	6	4
4	Data Entry Clerk/Computer Operator	10	5	3

4 PART D: IMPLEMENTING THE iHMS: GUIDELINES

Part C presents the minimum requirements and standards that the iHMS must meet to ensure that it create the value and the utility to its stakeholders. However, meeting the above mentioned requirements alone does not guarantee successful implementation and use of the iHMS in a hospital. Therefore in this part we provide a set of guidelines to ensure successful implementation and use of the iHMS.

Activities related to the implementation and use of iHMS in a hospital can be grouped into three main phases. They are planning, deployment, and maintenance and support. In the following sections, a set of activities and guidelines is presented for each of the phases.

4.1 Phase 1: Planning

Description

The implementation of the iHMS requires careful planning to ensure that the implementation proceeds in comprehensive, cost-effective and timely ways. This involves a range of activities including establishment of the governance structure, budgeting, development of the implementation work plan, acquiring the iHMS software, readiness assessment and procurement of the required computing infrastructure.

Objective

To ensure adequate allocation of resources for successful iHMS implementation

Scope

All iHMS implementation activities in the health facility shall be subjected to a formal business planning process.

Standard Guidelines

1. **Establishing iHMS Governance**

i. The implementation of the iHMS shall be transparently managed and inclusive to ensure broad-based buy-in from a range of stakeholders throughout the various phases of the implementation.

ii. All major stakeholders shall be in agreement as to who will assume responsibility for funding and carrying out tasks, and who will have the authority to make decisions.

iii. Each hospital shall form an iHMS steering committee to provide high-level oversight and provide a conduit between the implementation team, the hospital officials, MOHSW, PMO-RALG, and other stakeholders. The steering committee members shall consists of the hospital management team and other individuals that are identified as important during the iHMS implementation process.

iv. Each hospital shall establish an iHMS implementation team for daily operations of the system implementation and operations

v. Each hospital shall appoint implementation team leader who will be responsible to daily management and supervision of the implementation activities and report to the Medical officer In charge and steering committee

vi. The steering committee shall conduct a thorough review of each phase of implementation

vii. The MoHSW shall appoint national iHMS coordinator to oversee all activities and provide technical advice to the respective hospitals on matters related to the iHMS implementation and use.

viii. In all phases of the iHMS implementation, the hospital implementation team shall work closely with the national iHMS coordinator.

ix. A quality assurance officer shall be appointed in the hospital and shall be responsible for quality assurance of the iHMS project and shall work with the implementation team and all the respective hospital departments involved in the project.

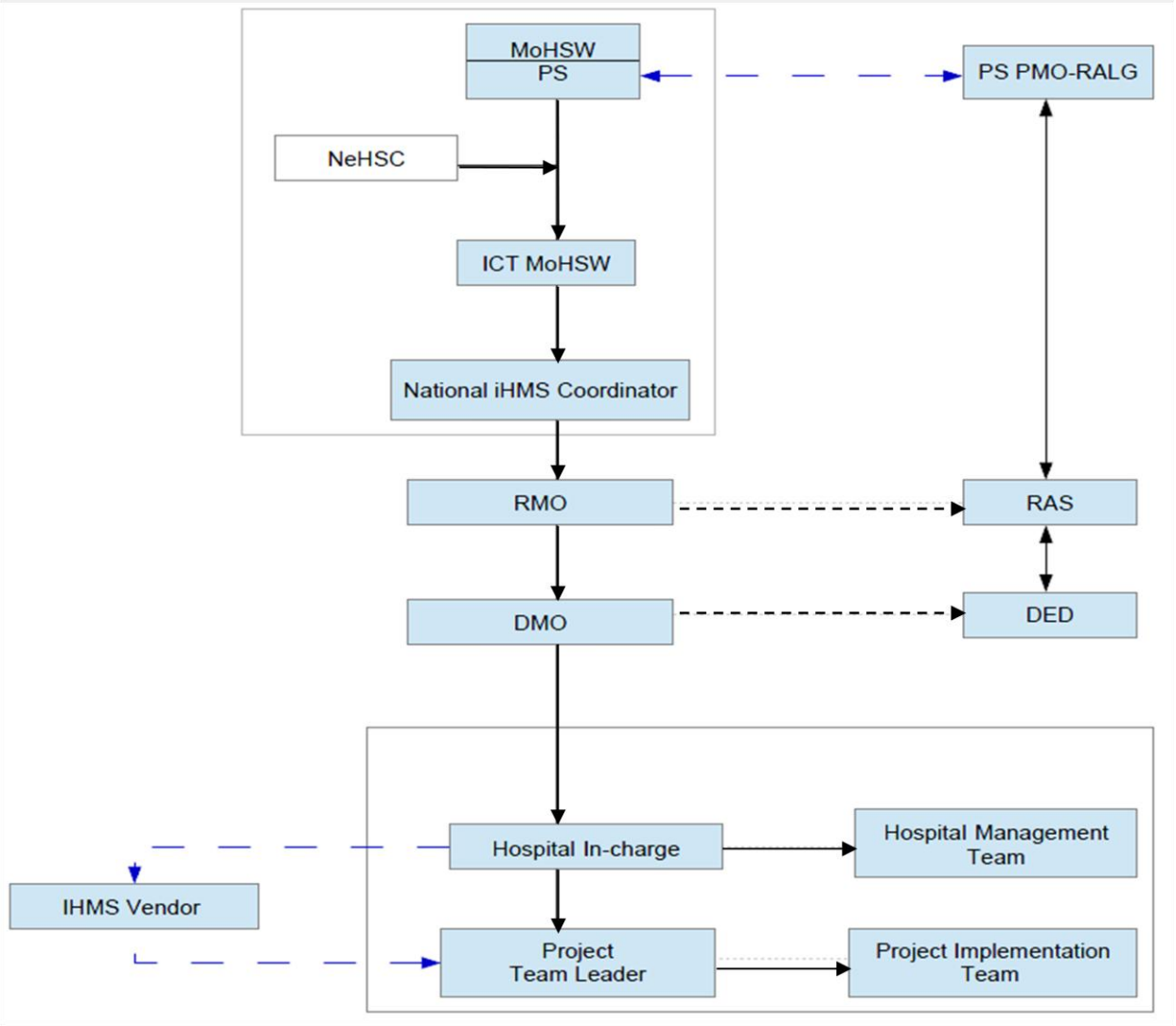

Figure 8: iHMS Governance Structure

Figure 8, presents an initial overall iHMS governance structure. The Permanent Secretary (PS) in the MOHSW should be the Executive Sponsor of the iHMS implementation Project. The overall oversight of this initiative should be led by the National eHealth Steering Committee. Key project decisions and go-ahead approvals should be presented to the group.

The iHMS implementation should be led by the Head ICT at MOHSW, who is the current Champion of the project on behalf of the MOHSW. The iHMS champion should be supported by the National iHMS Coordinator to ensure the attainment of established objectives. The National iHMS Coordinator should be supported by Hospital iHMS implementation Lead, at the hospital

level as local supervisor. The hospital level lead should be the primary link between the hospital iHMS steering committee and National iHMS Coordinator.

The overall oversight of the initiative at the hospital level should be led by the hospital iHMS Steering Committee. Key project decisions and go-ahead approvals should be presented to the group. The health facility in-charge shall be the chairperson for regional and district hospitals steering committees. Quarterly updates should be provided to National eHealth Steering Committee and the Permanent Secretary (PS) in the MOHSW who is the Executive Sponsor of this initiative.

Table 14: iHMS Hospital Level Implementation Team

Role	***Competencies***
iHMS Implementation Lead	Acts as the Champion at a hospital level Project Management Budgeting Communication Activity Coordinator at the hospital level
IT Systems Analyst	Requirements gathering, analysis, and recommendation Issue and change request analysis and prioritization
Procurement	Procurement of software, infrastructure and other hardware Contract Negotiations
System/Network Administrator	Installation, Configuration and Continuous troubleshooting of iHMS network and systems
IT Technician	Dealing with issues and request from end users
IHMS Trainers	Training planning Training need assessment Conduct training Perform training evaluation

2. Budgeting

Implementation of iHMS is a complex and challenging task. One obstacle to successful implementation can be the cost of converting to an electronic system when insufficient health care funding has been budgeted. It is essential that hospital management and stakeholders involved in planning for iHMS implementation understand what funding is available and develop a timeframe for funding in conjunction with timetables for implementation.

The high cost of the software and computers means that the initial costs associated with the introduction of an iHMS are significant, both in terms of time and finance. However, the ongoing costs of running an iHMS as well as longer-term issues of maintenance and support are significant as well.

Initial Cost	• Infrastructure (Data center, communication network, computers, Internet) • Software • Training • Consultants
Ongoing Costs	• Enhancements • Training of replacement staff members • Evaluations
Maintenance and Support	• Equipment maintenance: Care of equipment (computers, touch screens, keyboards, card readers, etc.) • Corrective maintenance: Fixing bugs in code • Adaptive maintenance: Adapting the software to new environments • Perfective maintenance: Updating the software according to changes in user requirements • Preventive maintenance: Updating documentation and making the software more maintainable.

3. Implementation Work Plan

The implementation of the iHMS requires a well established work plan. Therefore prior to commencing any activity, hospitals with the help of the National eHealth Entity (MOHSW ICT Unit) should create the implementation work plan. The work plan should explicitly state:

- Activity of the project
- Effort needed for each activity
- Dependencies of each activity
- Deliverables and milestones
- Resources assigned

A template of the implementation work plan is provided in Appendix A.

4. Acquiring the iHMS

Before implementing the iHMS in a health facility, the ministry or individual hospital through the iHMS Steering Committee has to decide how to acquire the software for implementation. There are two possible options to obtain the right software for the hospital. They are build and make, and purchase.

i. Make and Build from scratch or customization of an existing software

Options for acquiring software at a facility are either in-house or outsourced development of the system or customization of existing software from a vendor or free and open source system market. The ministry or individual hospital may consider using public private partnership (PPP) to acquire an iHMS through Build–operate–transfer (BOT) project financing form. Customized software is an alternative, which will deliver value to a hospital in providing software, which meets exact requirements as defined during analysis and specifications.

ii. Purchasing an existing software (Commercial-off-the-shelf software)

Another possible option to acquiring the software at a facility is to buy existing software from a vendor. This option is further divided into two alternatives.

- Purchase software as a product in which a hospital purchases software and host it and managing itself while paying for annual license and maintenance fees. The source code is coded by the vendor.
- Purchase software as service from a vendor who will be responsible for deployment, implementation and maintenance while a hospital will be paying fees for the service provided by the vendor. The vendor will have sole ownership of the system

There are several factors to consider when buying the software, however one of the main factor is the Total cost of ownership (TCO). TCO is a financial estimate of both the monetary impact and human resource impact of acquiring, deploying, and retiring an information technology system over the life cycle of the product. It is comprised of a number of factors that can be categorised as: Acquisition (one time) expenses and Operational (ongoing) expenses. The overall goal is to select technology that minimizes TCO while meeting minimum functional and operational standards. Other challenges which should be critically analysed in order avoid them from occurring include:

- Dependency on the software vendor which sometimes leads to vendor lock in
- Incompatibilities from future modifications or upgrades of other systems
- Difficulty in integration with other systems
- Security issues

When evaluating the total cost of ownership (TCO), the following factors are to be considered:

- Acquisition Expenses
    - Software licensing
    - Hardware (server, client workstations, mobile devices)
    - Infrastructure (networking hardware and software)
    - Technical support for installation and configuration costs
    - Initial training costs
- Operational (Ongoing) expenses
    - Software support – Configuration changes and version updates
    - Training costs

- Migration costs. Should it ever become necessary to move to another vendor or system then the data within the system should be easy to export to a standard open formats e.g. csv

5. Readiness Assessment and Implementation Analysis

i. Readiness Assessment

The primary purpose of the assessment is to identify the needs and determine hospital specific strategy for the iHMS implementation. The readiness assessment should be performed before procurement of the computing infrastructure. This assessment should include the following:

- Describe the current workflows and any changes needed for improvement
- Identify existing electronic systems for potential data migration and potential dependencies and interactions
- Existing hardware that can be used
- Infrastructure assessment (i.e. networking capacity, power, cooling system, physical security)
- Identification of staff
- Anticipation usage of the system
- Planning for computer placement
- Training need
- Any special consideration for the hospital

Role Involved	Responsible: MOHSW ICT (National iHMS Coordinator and Team) or Vendor. Helpers: Hospital implementation lead, IT Systems Analyst, staff Acceptance: Medical officer In charge Inform: Health Facility In charge, Steering Committee, National iHMS Champion
Dependencies	
Outputs and Impacts	Document: Hospital Implementation Readiness Assessment

Next steps(s)	Implementation Analysis
Resources and Tools	Hospital Implementation Readiness Assessment Tool (Appendix C)

ii. Implementation Analysis

Hospital must perform the implementation analysis. The primary input to this analysis is the implementation readiness assessment. The main purpose of performing the implementation analysis is to:

- Specify the workflows of the iHMS,
- Produce the computing infrastructure specification that include network and other infrastructure specification
- Identify staff and create training plan

Role Involved	Responsible: MOHSW ICT (National Project Manager and Team) or Vendor? Helpers: Hospital implementation lead, IT Systems Analyst, staff Acceptance: Medical officer In charge Inform: Medical officer In charge, Steering Committee, National iHMS Champion
Dependencies	Implementation readiness assessment - *Finished*
Outputs and Impacts	Decision: Agreed workflow Document: Computing Infrastructure Specification Document: Training plan
Next step(s)	Computing Infrastructure Specification
Resources and Tools	Computing Infrastructure Recommendation

6. Procurement of Computing Infrastructure

Procurement of power systems, Network systems, and hardware based on the computing infrastructure specification document from the implementation analysis task. Contracting for any installation should be in this task as well.

Roles Involved	Responsible: Procurement Helpers: IT System Analyst, System/Network Administrator Acceptance: Project Leader, IT System analyst, System/Network Administrator Inform: Medical Officer In charge, Steering Committee
Dependencies	Implementation analysis – *Started* Computing Infrastructure specification - *Finished*
Output and Impact	Action: Computing Infrastructure procured Action: Installation Contract in place
Next step(s)	Computing Infrastructure Installation Network and System Administration Training

7. Quality Assurance in Acquisition of iHMS and the Computing Infrastructure Equipment

Description

It is important to ensure that quality standards are observed when acquiring the iHMS and new hardware and software into the hospital operating environment.

Objective

To ensure that quality standards are implemented when acquiring the iHMS, computer hardware and software for usage within the hospital environment.

Scope

This guideline applies to the acquisition of the iHMS, new hardware, networking and software within the hospital environment

Standard Guidelines

i. The iHMS and the computing infrastructure equipment that shall be acquired and installed in the hospital environment shall be compliant with the requirements stated in this guideline document

ii. All off-the-shelf iHMS software and the computing infrastructure equipment shall be acquired from reputable companies with verifiable references and must comply with procurement regulations

Responsibility

Responsible Person/Team	Responsibilities
iHMS implementation team	1. Confirm terms of reference 2. ensure implementation of quality standards in the acquisition process 3. Address any recommendation from quality assurance
Quality Assurance Officer	1. Confirm terms of reference 2. Check compliance with standards and guidelines 3. Report QA findings to the facility in-charge

Procedure

The following quality standards should be considered for iHMS and the computing infrastructure equipment.

1. Prior to iHMS or any other software is acquired, there must be a formalized requirements specification document prepared based on the national iHMS standards and that will be signed off and approved.
2. All off-the-shelf software identified for acquisition should satisfy the formalized requirements specification document and should ensure minimal customization where possible.
3. It is highly recommended that vendors for off-the-shelf software should have implemented the software in at least one similar facility successfully and the reference should be verifiable.
4. The vendor should be able to offer support of the iHMS software post implementation.
5. Capacity building plan should be developed and approved in the acquisition process to ensure that internal staffs are capacitated to support the iHMS
6. For all acquired hardware there must be requirements specified by the user department which will be signed off and approved
7. All software and computing infrastructure equipment should have a warranty for a specified period of not less than 1 year

4.2 Phase 2: Deployment

Description

Deployment of the iHMS includes the following activities: installation of the computing infrastructure, deploying and configuration of the new iHMS software in its target environment, iHMS software acceptance testing, and training. Most importantly the training should include the following: basic computer training, iHMS software end user training, network and system administrators training and ICT governance training for managers.

Objectives

To ensure that the installation or implementation of computing infrastructure, iHMS software acceptance and Training is compliant with Organisation Guidelines and quality standards

Scope

To ensure that the iHMS is being deployed according the approved approach and Standards guidelines

Standard Guidelines

1. **Installation of Computing Infrastructure**

Prior to installation of iHMS software, the procured computing infrastructure must be delivered and installed. The installation should be performed by experts hired by the hospital through a competitive tendering process.

Roles Involved	Responsible: Vendor (Network and System Engineers) Helpers: hospital implementation lead, IT Systems Analyst, System/Network Administrator Acceptance: Medical officer In charge, National Project Manager Inform: Medical officer In charge, Steering Committee, national Champion
Dependencies	Procurement – *Finished*
Outputs and Impact	Action: Computing infrastructure Installed Document: Network Diagram, and System Configuration
Next step(s)	Server Setup and Software Installation
Resources and Tools	

The computing infrastructure should be appropriately documented to facilitate proper assessment, maintenance and support. The documentation should include network diagram, network devices configuration, and guidelines for data center management and network management.

2. Software Configuration and Installation

Once the computing infrastructures have been installed, the next step is the configuration and installation of the iHMS software. The configuration will include deployment of new forms, new reports and configuring the iHMS software for the specific hospital. The installation will include server and software installation. This will depend on the deployment architecture adapted by the Ministry and the hospital.

Role Involved	Responsible: Vendor (Software Engineer and System Administrator) Helpers: Implementation lead, IT System Analyst, Network/System Administrator Acceptance: Implementation Lead, National iHMS Coordinator Inform: Health Facility In charge, Steering Committee, MOHSW ICT
Dependencies	iHMS acquisition – Finished Computing Infrastructure Installation - Started
Outputs and Impact	Action: iHMS software configured and installed Document: System Configuration Document: Technical and user manual
Next step(s)	System Acceptance Testing
Resources and Tools	

The iHMS system should be appropriately documented to facilitate continuity among developers and the system users. The following types of documentation must be provided by the software vendor:

i. Technical documentation

Technical documentation should include maintenance and installation guides, ideally these should be available electronically as well as in printed format.

Technical documentation should also provides an overview of the system to enable further development work to happen without too much churn, it should include: diagrammatic illustrations of system data flow, logical and physical architecture, description of the software design methodologies, system code base, code patterns, description of the database design and the system's data dictionary.

ii. User documentation

User documentation is needed by system end users and should be written in simple, user-friendly language. User documentation should include electronic context sensitive help and printable training manuals. This document provides a step-by-step guide on iHMS system functionalities and instructions on how to use the system. It should cover how to run the system, how to enter data, how to modify data and how to save and print reports. It should include a list of error messages and advice on what to do if something goes wrong.

3. System Acceptance Testing

System testing is an important step when rolling out any software. Before the system is put into production, acceptance testing must be performed to get the buy-off of the functionality by the key stakeholders. This should be done after every release of the system.

Role Involved	Responsible: Vendor (Software Engineer and System Tester) Helpers: hospital implementation lead, Staff (target end users), National iHMS Coordinator Inform: Health Facility In charge, Steering Committee, national Champion
Dependencies	Software Installation – *Finished* Software Configuration - *Finished*
Outputs and Impact	Action: Stakeholders have approved the system
Next step(s)	Training
Resources and tools	System Acceptance Testing Tool

4. Training

Critical to the success of the iHMS implementation and use is training of human capital of the hospital. Users must be trained prior to iHMS implementation. Successful implementation will only occur if users like the system and commit to use it. Users need to understand what benefit the new system has for them, why they should use this new system, and how it is going to make their jobs easier. The hospital management needs to understand how it is going to make them and their hospital look better.

Hospital staff members must be trained in all aspects of managing the iHMS that are relevant to their roles and responsibilities. Specific training areas should include the following:

i. ***Basic computer training***: This training is aimed at providing basic computer skills needed for users to use a computer. All prospective users of iHMS should be trained.
   - The training should be conducted prior to the implementation of the system
   - It should be conducted by ICT staff of the hospital, or ICT staff from the regional and district administration departments.

ii. ***iHMS end user training***: This training should cover how to use iHMS.
   - The training should take the training-of-trainers (ToT) cascade approach.
   - The training should be conducted before the system is put into production
   - The iHMS vendor should provide a training of trainers (TOTs) before training end users. The target group should be ICT staff and one member from each functional department.
   - End user training should be conducted by the ToT.
   - End user training should be user focused and tailored to individuals' roles in the hospital and not the system functionality focused.

iii. ***Network and System Administration Training***: The technical training is targeted at the ICT personnel at the hospital. It covers areas related to planning, design, deployment, operationalization and management of IT infrastructure and information systems.

- It should be conducted after installation of the computing infrastructure and the software
- It should be conducted by iHMS vendor experts and coordinated by ICT units at POMRALG and MoHSW in consultation with hospital iHMS steering committees.

iv. ***ICT governance***: The ICT governance training aims at building the knowledge of managers and members of the steering committee with knowledge and concept about the iHMS project generally. Participants of the training should include members of steering committees, health management team and hospital management teams.

- This training should be conducted during kick off of the iHMS implementation project in respective hospitals
- It should be conducted by experts and coordinated by ICT unit at POMRALG and ICT unit at the MoHSW.

Role Involved	Responsible: Trainers Helpers: Hospital Implementation Lead, Vendor Acceptance: Health Facility In charge Inform: Health Facility In charge, Steering Committee, National iHMS Champion
Dependencies	Software Configuration – *Finished* System Acceptance Testing - *Finished*
Outputs and Impact	Document: Training materials Action: end user trained and evaluated
Next step(s)	Trial-run
Resources and Tools	

5. Trial-run/Deployment Approach

Before the new system is put into production it should be piloted. After users have been trained, hospitals should run a limited trial-run of the iHMS in parallel to any previous system (paper or otherwise) to allow users to test their knowledge in using the system and make sure they full understand how to perform their job with the new system in place. At the end of the

trial-run, the trial-run must be assessed to determine whether the hospital is ready to go to production use of the new system. The assessment should be guided by a well define Trial-run to Production Readiness Assessment Tool (see Appendix D).

Roles Involved	Responsible: Vendor Helpers: Health Facility In charge, Hospital staff, National iHMS Coordinator Acceptance: Health Facility In charge Inform: Health Facility In charge, Steering Committee, National iHMS Champion
Dependencies	System Acceptance Testing – *Finished* Training - *Finished*
Outputs and Impact	Action: Users using the system in timely manner, consistently, and accurately Action: Hospital passes pilot to production readiness assessment
Next step(s)	Pilot to production
Resources and Tools	Pilot to Production Assessment Tool

6. Trial-run to Production

Once the hospital has passed the readiness assessment during the trial-run, the system should be moved into production.

Roles Involved	Responsible: Vendor Helpers: Health Facility In charge, Hospital staff, National iHMS Coordinator Acceptance: Health Facility In charge Inform: Health Facility In charge, Steering Committee, National iHMS Champion
Dependencies	Pilot– *Finished*

Outputs and Impact	Action: New system is in use for production; previous systems are deprecated and cycled out of production
Next step(s)	
Resources and Tools	

7. Quality Assurance During iHMS Implementation

Description

Quality should be observed at implementation of iHMS project as well as installation of other software and computing infrastructure equipment.

Objective

To ensure that the installation or implementation of software and computing infrastructure equipment is compliant with standards and guidelines

Scope

This applies to all software and computing infrastructure equipment in the health facility environment

Standard Guidelines

i. The implementation of the iHMS and the computing infrastructure shall be compliant with the national iHMS standards and guidelines

Responsibility

Responsible Person/Team	Responsibilities
iHMS implementation team	1. Ensure implementation of quality standards in the acquisition process 2. Address any recommendation from quality assurance
Quality Assurance Officer	1. Check compliance with standards and guidelines 2. Report QA findings to the facility in-charge

Procedure

1. Implementation of the iHMS and the computing infrastructure should be compliant with the national iHMS standards and guidelines. The following should be considered:

- A quality plan should be developed and referenced in the implementation process and it should be approved by the iHMS steering committee.
- Quality assurance should be deployed at all stages to ensure that the standards are maintained at all times.
- Only competent individuals should be in the iHMS implementation team.

1. The quality assurance officer (QAO) shall ensure that the implementation of the iHMS is in line with the stipulated guidelines related to iHMS software and the computing infrastructure. Where there are variations the QAO shall flag all the issues to the implementation team and the steering committee

4.3 Phase 3: Maintenance and Support

Description

Maintenance and support of the iHMS operations is an essential ingredient in making its adoption successful and thus achieve the intended organizational goals. Maintenance aims at retaining the system in the working state, with support of the ICT Team to enable users achieve their objectives. Furthermore maintenance includes both preventive and incidental maintenance.

On the other hand, support include additional training, assisting end users, modifications and enhancements, disaster preparedness and recovery as well as undertaking activities such as upgrades, migration, re-installing software, trouble shooting, and regular assessment of system usage.

Objective

To guide iHMS maintenance and support activities to ensure smooth system performance and usage

Scope

The support and maintenance guidelines and procedures cover iHMS software, computing infrastructure equipment and end users

Standard Guidelines

i. Initial maintenance and support shall be provided by the supplier of the iHMS for at least six months, and should be part of the supply and implementation contract
ii. Health facilities shall have at least one year maintenance and support Service Level

Agreement (SLA) with the supplier of the iHMS after commissioning

iii. Health facilities shall put in place change management mechanisms for identifying changes in hospital functions and workflows that needs to be reflected and accommodated in the iHMS, and continuously track and identify bugs or errors (see iHMS change management sub section below)

iv. Health facilities shall ensure security of ICT infrastructure and systems and patient and other business data and information. (see iHMS security monitoring subsection)

Responsibility

End users	1. Request support and maintenance services from approved ICT personnel/ Team 2. Maintain proper operations of the system and related hardware
ICT Team	1. Ensure that all support activities are done in a timely manner in accordance to support and maintenance guidelines 2. Ensure that competent and approved personnel carry out support either internally or externally 3. Liaise with the vendor on addition and modification of iHMS functionalities 4. Determine and conduct continuous training to end users

1. iHMS Change Management

Description

This guideline ensures standardized methods, processes and procedures are used for all changes, and maintain proper balance between the need for change and the potential detrimental impact of changes. Effective change management is very crucial in hospital settings for controlling changes to iHMS and other supporting systems within the live hospital environment.

Objective

To implement formal change management control procedures that protect hospital information assets and to ensure that the change management procedure is used for efficient, planned, authorized and prompt handling of all changes, in order to minimize the impact of any related incidents upon service provision in a live healthcare environment.

Scope

This guideline addresses the definition and documentation of hospital information assets change management control procedures. The guideline applies to normal and emergency changes that affect the iHMS, and the computing infrastructure including network, and hardware, software and all documentation and procedures associated with the running, support and maintenance of live ICT systems in the hospital settings. Changes to iHMS and other supporting systems & applications include the following categories:

i. Changes to hardware and hardware configurations;
ii. Changes to operating systems and operating system configurations;
iii. Changes to iHMS software and other supporting application software configurations;
iv. Changes to user access configurations;
v. Changes to network and communication device configurations;
vi. Changes to configuration of physical access and environmental control devices.
vii. iHMS Functionality enhancements

Standard Guidelines

Changes to all information processing facilities, systems, software, or procedure should be strictly controlled according to formal change management procedures. This section contains the Standard guidelines.

i. **Change Initiation:** All system changes shall be initiated by filling in the change control form, which will be signed by the respective heads of department, and addressed to the ICT department.
ii. **Change Authorization:** Authorization for any changes, whether urgent or not, shall be given by the head of the ICT department if satisfied that the reason for the change is sound and that there is no adverse effect as a result of the change.
iii. **Testing of changes:** All testing shall be done from a test environment. No change will be applied to the live/production environment without having been tested in the test environment.
iv. **Change approval:** The concerned user departments shall check the system to see whether the results produced are as expected and a user acceptance testing (UAT) form shall be signed off.
v. **Change Scheduling:** To minimize disruption to the normal working operations of the hospital, no changes shall be effected in the system during normal working hours unless absolutely necessary. All changes will be scheduled during weekends, public holidays or after business working hours.
vi. **Change Communication:** All planned system changes shall be communicated in advance to the concerned parties to minimize on business disruption and inconveniences. For avoidance of doubt, no scheduled system change should be effected in the live iHMS during a busy business cycle.

vii. **Change Recovery, Safety measures:** Before effecting any change in the production environment, a backup on a clearly labelled storage media shall be taken and kept for good. In the event that the change made produces unexpected results, the backup taken before the change was effected has to be used to restore the system to the point before the change.

viii. **Change Documentation and tracking:** All system changes, whether approved or not shall be documented and filed. The documentation shall include a duly completed and signed off "change request form", the test results and any other comments/documents used.

2. iHMS Security Monitoring

Description

This guideline and its supporting standards outline the requirements needed to protect the iHMS information through the enforcement of logging, monitoring and auditing processes

Objective

To provide for the tracking of computing resource activity that will benefit the disclosure of unauthorized activity and to ensure the security status of the iHMS is known and understood by those who are responsible for maintaining that security.

Scope

The tracking of security related events and the data logs produced by the tracking mechanisms.

Standard Guidelines

i. All accesses that are denied will be logged. Each denied access is considered a security "event", but not necessarily a security "violation". Daily logs of all security events will be reviewed for unusual security events with further investigation of unusual events.

ii. Sufficient information for after-the-fact investigation of unauthorized activity must be logged. At a minimum the information in the tracking record associated with each event must include: User ID; Associated terminal, port, network address, communication device; Information or system accessed; Date and time of access; and Event Description.

iii. Hospital computing resources should be sufficiently monitored by IT security manager to detect deviations from authorized use.

iv. Regular monitoring of the secure status of all hospital electronic information must be undertaken, principally through the applications, platforms and infrastructure that supports it.

v. Monitoring of user activity on hospital applications and the platforms supporting them must be undertaken on a regular basis, using the logs of user activity provided by those systems.

vi. Any actual or suspected breach of security or related incident will be reported, recorded and appropriate action taken to limit and remedy any impact on the security of the hospital.

vii. The hospital reserves the right to conduct all such monitoring activities on its systems as are necessary to preserve and measure the security of its information and assets.

viii. All employees, agents and contractors who make any use of hospital systems must be informed of the hospital's right to monitor all such use and inspect any information entrusted to hospital systems, whether personal or not.

ix. Monitoring of hospital systems and access to logs and other information produced during monitoring must be restricted to employees specifically authorized to conduct such monitoring as part of their normal duties.

x. Measures must be put in place to protect logging facilities and log information against tampering and unauthorized access.

xi. The clocks of all relevant information systems (e.g., networking devices, servers, and PC's) must be synchronized with an accurate time source for accuracy of timestamps on logs.

Responsibility

Roles	**Responsibilities**
All Users	All hospital users who are in possession of, or control access to hospital information or computers covered by this Guideline are responsible and accountable for its protection in accordance with this Guideline and supporting guidelines and procedures.

5 MONITORING AND EVALUATION (M & E)

Description

Monitoring and evaluation is vital to ensure successful implementation and smooth operation of iHMS. As part of M & E, quality assurance exercise should run throughout the life cycle of the project especially during procurement of the iHMS and implementation process to ensure compliance with the national iHMS standards and guidelines. Furthermore, it is necessary to track and evaluate the implementation and functioning of the system in order to understand how well the implementation objectives have been met and the effect of iHMS in the day-to-day hospital operations.

Objective

- To ensure iHMS implementation activities are performed as intended, compliant with the national iHMS standards and guidelines and the system is functioning as expected
- To measure the effects of the iHMS in the hospital performance such as boosting hospital revenues, improving administration and service provision, as well as preventing loss of medicines and other medical supplies

Scope

Applies to all activities pertaining to the implementation and use of iHMS

Standard Guidelines

i. Monitoring and Evaluation shall run throughout the life span of the iHMS implementation project
ii. Health facilities shall develop an M & E plan during the planning phase as an integral component of the iHMS implementation work plan.
iii. Health facilities shall assess whether implementation activities have been performed as intended, and the system is functioning as expected.
iv. Hospitals shall measure the effects of the iHMS, by assessing its impact or outcome including:
    a. Whether it boost hospital revenues
    b. Improve hospital administration
    c. Improve performance of hospital operations
    d. Prevent loss of medicines and other medical supplies
    e. Enable and improves patient tracking

Procedures

- Develop an M&E plan describing:
    - What will be monitored and/or evaluated
    - What data are needed and will be collected
    - How data will be used
    - How M&E activities will be managed and supported
- Develop a monitoring toolkit (methodologies, tools, and analysis plan)
- Carry out the M & E exercise based on the plan and the implementation phase
- Make use of monitoring findings
- Take action and document lessons
- Submit monitoring & evaluation report to the relevant authorities.

6 iHMS IMPLEMENTATION CLOSURE AND SIGN-OFF

Description

iHMS implementation closure and sign-off is a formal process of winding up the activity. It helps the health facility management to account for the activities and the deliverables.

Objective

To confirm and approve the final iHMS project deliverables and officially close the iHMS implementation

Scope

The scope covers the entire iHMS implementation within the health facility setting.

Standard Guidelines

i. The iHMS implementation must come to an end either through abortion or completion and in all cases closure processes and sign- off shall be conducted and completed
ii. The completed iHMS implementation must be officially signed off by health facility in-charge
iii. The iHMS implementation must come to an end after all the deliverables have been delivered and accepted by the user departments
iv. All deliverables resulting from the iHMS implementation shall be recorded and archived.

35.5 Responsibility

Roles	**Responsibilities**
User department	Approve and signoff deliverables (Modules)
iHMS implementation leader	1. Ensure that all project deliverables are completed 2. Confirm with user departments for all completed deliverables 3. Record and achieve completed deliverables 4. Submit deliverables to the health facility in-charge
Health Facility in-charge	Approve and sign off completed deliverables.

35.6 Procedure

The iHMS implementation closure procedure shall commence with the delivery and handover of the project final deliverables to the user department.

2. Upon the user department testing and accepting the deliverable(s), a sign-off or a rejection of the deliverable(s) shall be made by the head of the user department.

3. Rejection of the deliverable shall lead to a rework in order to address all the issues raised.
4. Document lessons learnt from iHMS implementation
5. Documentation of any outstanding issues
6. Documentation of iHMS project risks
7. Acceptance of the iHMS implementation deliverables
8. All hard copy documentation such as signed off files and documentation shall be compiled, indexed and archived using the hospital archiving procedures.

7 GUIDELINES FOR ACCESSING COMPLIANCE OF EXISTING iHMS

Descriptions

It is undeniable fact that there are efforts to computerize various clinical and administrative functions noticeable in some health facilities in the country. While there is significant improvement in management of health resources and service provision in those facilities, the degree of success on these automations varies significantly, with some obtaining suboptimal results. In order to ensure that hospitals accrue maximum benefits from the existing systems and be able to address issues of standards and data exchange, a number of activities need to be carried out by the respective facilities. This will ensure that the existing systems become compliant with the national iHMS standards and guidelines.

Objective

To guide health facilities with existing iHMS to improve their systems to meet the national iHMS standards and guidelines

Scope

The guidelines cater for the health facilities that need to improve their existing iHMS.

Standard Guidelines

i. Health facilities with existing iHMS should conduct assessment to ensure compliance with the national iHMS implementation standards and guidelines.
ii. The health facilities with existing iHMS that meets the stipulated national standards upon passing rigorous assessment by MoHSW eHealth entity in collaboration with the health facility shall officially be certified as an indication of compliance with the national iHMS standards and guidelines.
iii. The health facility that fall short of the stipulated national iHMS guidelines and standards shall improve their existing system by following the stipulated standards, guidelines and procedures (See Figure 9).
iv. Following improvement of the existing iHMS, the health facility shall conduct again a thorough and rigorous assessment of the same, to ensure compliance with the national standards and guidelines. Upon passing the rigorous assessment the health facility shall be certified by the MoHSW eHealth entity as an indication of compliance with the national iHMS standards and guidelines.
v. The existing iHMS systems that prove difficult to improve as per the rigorous assessment and a thorough cost-benefit analysis of the system conducted by the hospital in collaboration with the national eHealth entity shall require total

replacement. The health facility shall then follow the stipulated guidelines and procedures to acquire and implement a new iHMS system (Refer to Figure 9)

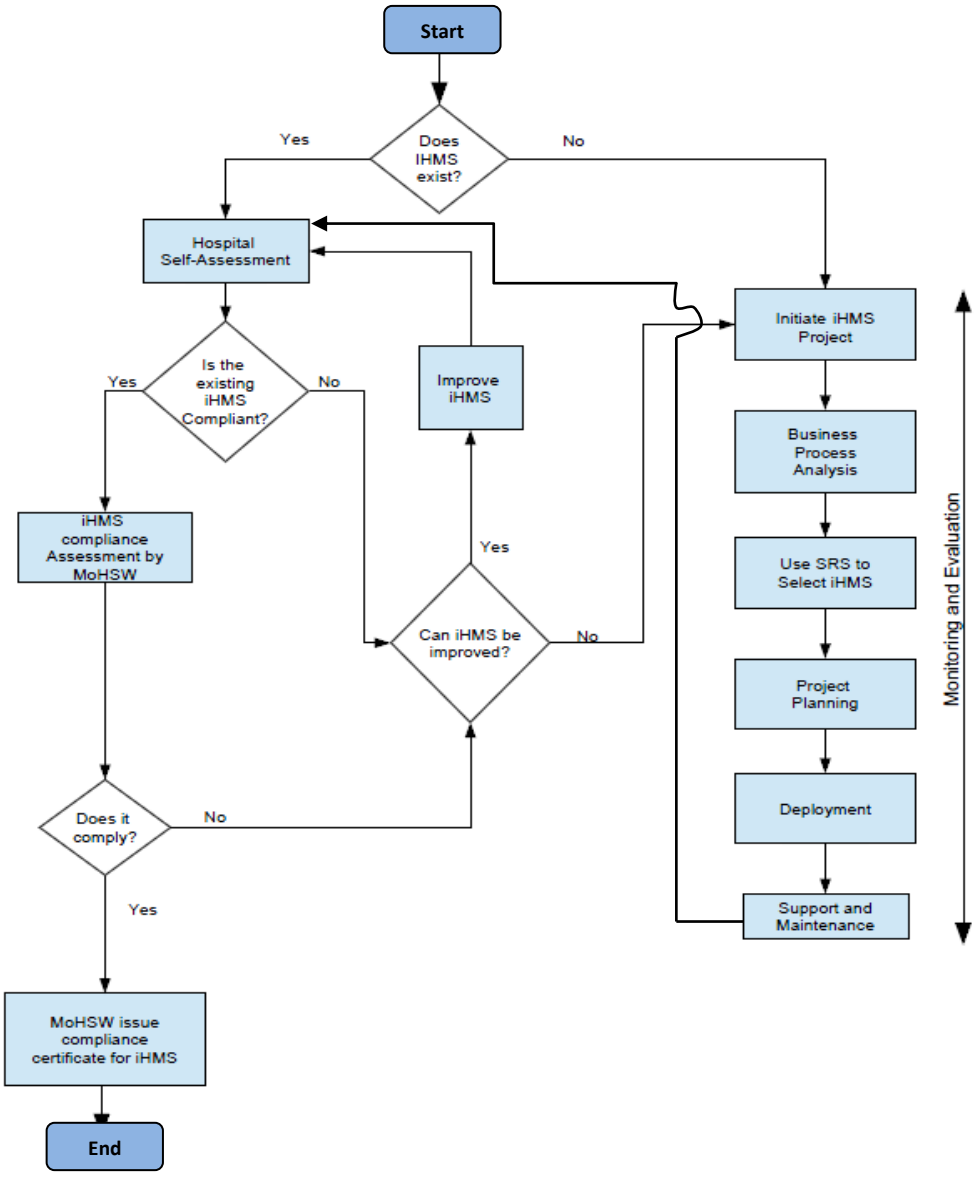

Figure 9: Flow of Activities for Assessing and Improving an Existing iHMS

Responsibilities

Responsible Person/team	Roles
M & E team	3. Prepare, review and test the iHMS assessment tool using the iHMS assessment template 4. Conduct assessment of the existing iHMS 5. Analyze the data and prepare assessment report 6. Share assessment report with the hospital in-charge
Hospital Management Team	7. Review the assessment report and make a decision as per the national iHMS standards and guidelines 8. Take action to certify, improve or replace the existing iHMS with a new system as per the assessment results

Procedures

i. Review the standard iHMS assessment tool. Health facilities are at liberty to add more parameters in the assessment tool, as long as the standard parameters remain intact.
ii. Test and review the assessment tool to ensure consistent and effective results
iii. Conduct the assessment of the existing iHMS covering all the areas stipulated in the tool
iv. Conduct data analysis and report writing
v. Submit the assessment report to the facility in-charge, who will table it to the hospital management team for review, and comments
vi. Take action in-line with the assessment results and the national iHMS standards and guidelines (Refer Figure 9**)**

8 APPENDICES

8.1 Appendix A: Implementation Work Plan Template

Purpose: To plan, procure and implement an integrated Health Management System (iHMS) in a healthcare facility.

	Activities	Input	Responsible Person	Outputs and Target
Phase 1 – Planning				
1.1	Formation of Hospital iHMS steering committees	• iHMS implementation Guidelines	• Hospital • MOHSW ICT	iHMS steering committees
1.2	Formation of Hospital iHMS implementation team	• iHMS implementation Guidelines	• Hospital • MOHSW ICT	iHMS implementation team
1.3	Appointing iHMS project team leader	• iHMS implementation Guidelines	• Hospital • MOHSW ICT	iHMS project team leader
1.4	Preparation of the iHMS implementation budget	• Feasibility Study Report • iHMS implementation Guidelines	• iHMS implementation team • Hospital iHMS steering committees • iHMS project team leader • MOHSW ICT	iHMS implementation budget
1.5	Resource mobilization for iHMS implementation	• iHMS implementation Guidelines	• MoHSW • iHMS implementation team • Hospital iHMS steering committees • iHMS project team leader • MOHSW ICT	Required resources available
1.6	Creating Implementation Work Plan (using this template)	• Feasibility study report • iHMS implementation Guidelines	• iHMS implementation team • Hospital iHMS steering committees	Implementation Work Plan

			• iHMS project team leader • MOHSW ICT	
1.7	Conducting iHMS stakeholder awareness workshop including all top level hospital officials	• iHMS implementation Guidelines	• iHMS implementation team • Hospital iHMS steering committees • iHMS project team leader • MOHSW ICT	iHMS stakeholder awareness workshop
1.8	Acquiring the iHMS Software	• iHMS implementation Guidelines	• iHMS implementation team • Hospital iHMS steering committees • iHMS project team leader • MOHSW ICT	iHMS Software
1.9	Conducting Hospital Readiness Assessment	• iHMS implementation Guidelines	• iHMS implementation team • iHMS project team leader • MOHSW ICT	Hospital Readiness Assessment report
1.10	Conducting iHMS Implementation Analysis	• iHMS implementation Guidelines	• iHMS implementation team • iHMS project leader • MOHSW ICT	iHMS Implementation Analysis report
1.11	Procurement of Computing Infrastructure	• iHMS implementation Guidelines • Funds	• iHMS implementation team • iHMS project leader • Procurement unit • MOHSW ICT	Computing Infrastructure equipment

Phase 2 – Installation				
2.1	Installation of Computing Infrastructure	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS project leader • MOHSW ICT	Computing Infrastructure
2.2	Software Configuration and Installation	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS project leader • MOHSW ICT	Software Configured
2.2.1	Preparation of Technical documentation	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	Technical documentation
2.2.2	Preparation of User documentation	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	User documentation
2.3	System Acceptance Testing	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	System Acceptance Testing report

2.4	Training			
2.4.1	Basic computer training	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	Hospital Staff trained on basic computer
2.4.2	iHMS end user training	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	Hospital Staff trained on iHMS
2.4.3	Network and System Administration Training	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	Network and System Administrators trained
2.4.4	ICT governance Training	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	Managers trained on ICT governance
2.5	iHMS Piloting	• ToR • iHMS implementation Guidelines	• Consultant • iHMS implementation team • MOHSW ICT	iHMS piloted
2.6	iHMS production	• ToR • iHMS implementation	• Consultant • iHMS implementation	iHMS in actual use

		Guidelines	team • Hospital iHMS implementation leader • MOHSW ICT	
3.0	***iHMS Maintenance and Support***			
3.1	Provision of iHMS maintenance and support for a period of six months (should be part of the implementation contract)	• iHMS software maintenance & support plan • iHMS performance analysis tool	• iHMS Consultant • iHMS implementation team • Hospital iHMS implementation leader • MOHSW ICT	List of issues attended
3.2	Monthly maintenance and support reports covering issues reported and attended to, performance of the hospital based on the system performance analysis tool	• List of issues attended	• iHMS Consultant • iHMS implementation team • Hospital iHMS project leader • MOHSW ICT	iHMS monthly maintenance and support reports
3.3	One year maintenance and support Service Level Agreement (SLA) with the supplier of the iHMS after commissioning	• iHMS quarterly maintenance and support reports • Final project implementation report	• MoHSW • iHMS Consultant • iHMS implementation team • Hospital iHMS project leader • MOHSW ICT	iHMS maintenance and support Service Level Agreement (SLA)

8.2 Appendix C: Implementation Readiness Assessment Tool

8.3 Appendix D: Trial-run to Rollout Assessment Tool

Position _____ Department_____

Business Process: _____

	5	4	3	2	1	Reasoning/ Comments (if any)
	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	
A: Perceived Easy of Use						
1. I found the system easy to use						
2. It was easy to learn how to use the system						
3. The system was flexible to interact with						
4. I would like to continue to use the system to do what I do						
5 It was easy for me to get help in the system						
B: Perceived Usefulness						
6. The system has improved my work						
7. I think the system will improves facility operations						
8. I think the system reduce patient waiting time						
9. I was able to enter the data correctly						
10. The system has helped me to identify problems with the data entered						
11. Did the system helps you identify adherence issues						
C: Intention To Use						
12. In the future I would like to use the system to perform my						

	work					
13.	I will promote the use of system in my section					
14.	I need more time to learn how to use the system before using it for my daily work					
15.	I recommend the rollout of the system					