"Customization of DHIS Hospital for NIKDU Hospital Bangladesh"

A Dissertation Proposal for

Post Graduate Diploma in Health and Hospital Management

by

Poonam Sandhu
PG/11/069

International Institute of Health Management Research
New Delhi

May 6, 2013

Customization of DHIS Hospital for NIKDU Hospital Bangladesh

A dissertation submitted in partial fulfilment of the requirements for the award of

Post-Graduate Diploma in Health and Hospital Management

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May, 2013

HISP INDIA SOCIETY FOR HEALTH INFORMATION SYSTEMS PROGRAMMES

April 7, 2013

To Whom It May Concern

This is to inform, that Dr. Poonam Sandhu, student at International Institute of Health Management Research (IIHMR), New Delhi, has successfully completed internship with the Society for Health Information Systems Programmes, India (HISP India) working with various Indian states in setting-up e-Health systems, from January 2013 to March 2013. Her contributions have been in Customization of DHIS Hospital for deployment in Bangladesh.

She came across as a good team member with potential of being an asset to the organisation her works. I wish her good luck.

(Sundeep Sahay)

Certificate of Approval

The following dissertation titled "**Customization of DHIS Hospital for NIKDU Hospital,Bangladesh**" is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

Name	Signature
Avanish Kr. Singh	
Anandi Ramadeh	

Certificate from Dissertation Advisory Committee

This is to certify that **Ms Poonam Sandhu**, a graduate student of the **Post-Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. She is submitting this dissertation titled "**Customization of DHIS Hospital for Bangladesh**" in partial fulfilment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

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

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FEEDBACK FORM

Name of the Student: **Poonam Sandhu**

Dissertation Institution: **HISP India**

Area of Dissertation: **Health Informatics – Hospital Information Systems**

Attendance: **100%**

Objectives met: **yes**

Deliverables: **Requirement Study of District Hospital, Customization of DHIS Hospital for deployment in Bangladesh; Documentation**

Strengths: **Poonam is intelligent and quick learner. She complete work very diligently and ensures quality. She is good at multi-tasking and responsible**

Suggestions for Improvement: **should always be good learner**

Wishing her all the very success for future endeavors

Arunima S Mukherjee

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

Date: April 7, 2013
Place: Shimla

ABSTRACT

Customization of DHIS Hospital for Bangladesh

Problem Statement :

A **hospital information system (HIS)** is essentially a computer system that can manage all the information to allow health care providers to do their jobs effectively. These systems have been around since they were first introduced in the 1960s and have evolved with time and the modernization of healthcare facilities.

Information systems can be customized according to the specific requirements of a hospital. A hospital can tell the solution provider its needs and the applications can then be moulded to deliver exactly what was demanded.

Even if there is a modest increase in cost, the benefits of having a tailored solution in terms of future time and cost savings will usually offset this quite rapidly.

Therefore, capability for extensive customization is considered one of the most important aspects of a hospital information system.

The processes and working of hospitals in Bangladesh is quite different from those in India. It is important to understand these nuances and incorporate them into the information system for maximum user satisfaction and implementation success.

Government of Bangladesh plans on implementing DHIS HOSPITAL in all Government run hospitals in Bangladesh over a period of time. However, initially, the same will be implemented in three hospitals namely, National Institute of Kidney Diseases and Urology (NIKDU), Government Employee Hospital (GEH) and Mother and Child Health Tracking Institute (MCHTI). This study was conducted in NIKDU, Bangladesh.

Following implementation of DHIS Hospital:

- Old practice of having to maintain registers, then transferring the data manually into DHIS2 for generating GoB reports will be done away with.

- Direct transfer of name-based patient data to DHIS2 for aggregate reporting. Along with that, facilitation of patient care , accountability of employees and streamlining of processes will be brought about.

Objective

To study the process of customization of DHIS Hospital for NIKDU, Bangladesh.

Methodology

This was a qualitative study for which information was collected by hands-on experience on customization and testing as well as reviewing various papers and manuals.

Conclusions

Hospitals in Bangladesh have been eager towards and welcoming the change that will be brought about by DHIS Hospital. Following implementation of DHIS Hospital, the old practice of having to maintain registers and then transferring the data manually into DHIS2 for generating GoB reports will be done away with. Employees will be able to directly transfer name-based patient data to DHIS2 for aggregate reporting. Along with that, facilitation of patient care , accountability of employees and streamlining of processes will be brought about.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to Prof. Sundeep Sahay, president HISP India for giving me the opportunity to work with the dedicated staff of HISP India where my dissertation study was undertaken.

I hereby express my deep gratitude towards **Ms. Arunima S Mukherjee**, Project-Lead Coordinator, HISP India, and my internal mentor **Prof. Anandhi Ramachandran** for their valuable guidance, support, interest, involvement, encouragement and advice which inspired me greatly to work on this project.

I would also like to thank my family and friends for their cooperation extended to me at all the times which made it possible for me to complete my dissertation.

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LIST OF ABBREVIATIONS

HISP – Health Information Systems Program

NGO – Non Governmental Organisation

DHIS – District Hospital Information System

NHSRC – National Health Systems Resource Centre

SDMx HD – Statistical Data Metadata Health Domain

WHO – World Health Organisation

BIRT – Business Intelligence and Reporting Tools

CCEM – Cold Chain Equipment Management

FSNIS – Food Security and Nutrition Information System

iHRIS – Integrated Human Resource Information System

NIKDU – National Institute of Kidney Diseases and Urology

GEH - Government Employee Hospital

MCHTI - Mother and Child Health Tracking Institute

MIS – Management Information System

CDS – Clinical Decision Support

EMR – Electronic Medical Record

HIS – Hospital Information System

MO – Medical Officer

OPD – Out Patient Department

IPD – In Patient Department

DMS – Department Management System

SOP- Standard Operating Procedure

FAQ- Frequently Asked Questions

PART I : INTERNSHIP REPORT

Introduction : H*i*SPindia PROFILE

H*i*SPindia is a not-for-profit NGO specializing since more than a decade in designing and implementing solutions in health informatics for the public health sector in Indian states, and also recently in Bangladesh and Sri Lanka. It is not a solely technology focused organization, but a multi-disciplinary organization concentrating on the domains of public health and informatics. The organization has a strong commitment to free and open source technologies, and works with a global perspective of the **Health Information Systems Programmes (HISP) network**, coordinated by the University of Oslo, Norway, and is active in more than 20 countries in Africa and Asia. H*i*SPindia has a registered and head office in New Delhi, and project offices in Kerala, Himachal Pradesh, and Punjab. The team members are intensively travelling to different parts of the country to provide technical support services.

i. VISION

"To enable and coordinate a network of excellence in public health informatics, specializing in integrated health information architectures, with a geographical focus on South-East Asia."

ii. HISTORY

In 1999, an informal group of idealists got together to start a project in a primary health centre in the remote villages of Kuppam, Chittoor district in Andhra Pradesh. These efforts were supported by the University of Oslo, Norway, and had initial partnerships with IIM Bangalore and ASCI Hyderabad. During the first five years, it remained focused on Andhra Pradesh and carried out implementations of the first version of the DHIS software application. From 2005, it started to work in the State of Kerala first in one facility and by 2008 all the facilities were reporting data in the DHIS2. The DHIS2,which is a global standard today for facility reporting, took birth in a clinic in Kerala in 2006. The

achievements in Kerala prompted the state of Gujarat first, and then Jharkhand and Madhya Pradesh to initiate DHIS2 implementations. This led to collaboration in 2008 at the national level with National Health Systems Resource Centre (NHSRC) to provide technical support on DHIS2 nationally. About 25 states took up DHIS2 in 2008. Today, HISP has gained international recognition, and has also been invited to provide technical support in Bangladesh, Sri Lanka, Rwanda, and Philippines.

iii. GEOGRAPHICAL COVERAGE

With a 30 team members, HISP has a strong national and global coverage of work. In India, it has worked in at least 90% of the states, and currently has a presence in about 20 states. Internationally, H*i*SPindia has worked in Bangladesh and Sri Lanka, and on an individual basis, experts have contributed to Global HISP activities in various countries including Vietnam, Tanzania, Zanzibar, Ethiopia, Mozambique, South Africa, and those in West Africa.

DHIS Hospital

Strengthening clinical care, hospital management and administration

Continuity of care is crucial for managing chronic patients - Information is care.

Key features

• Unique integrated hospital management system based on OpenMRS for clinical, management and administrative systems, customized specifically for workflow process within a district hospital system.
• Provides for an integrated suite of 10 modules such as Registration and Billing, plus two common modules – hospital core for managing the other modules, and a reporting module.
• Integrated with DHIS2 using WHO SDMX.HD standard. Semi-permanent data for the hospital will be stored (such as details of the beds and doctors) stored in DHIS2. Patient level data from DHIS Hospital will be aggregated and exported into the DHIS2, enabling the generation of management indicators, such as Bed utilization rates and Average length of

stay, and presented as tables, graphs and charts and do inter-hospital comparison to support management analysis.
• A suite of reports have been developed using BIRT for supporting clinical, administration, and managerial systems reporting and strengthening.

Tasks done while interning :

- Testing DHIS Hospital for 11 districts of Himachal Pradesh.
- Requirement gathering for 2 hospitals of Himachal Pradesh.
- FSNIS data verification.
- CCEM manual creation.
- Quality check performed for various manuals and other literature like DHIS2 manual etc.
- Preliminary Punjab Cancer data analysis.
- iHRIS testing

Work Plan :

Activities	January				February				March				April
		W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1
Introduction to DHIS2													
Introduction to DHIS Hospital													
CCEM Manual creation													
FSNIS Testing													
Workshop													
Testing DHIS Hospital for HP Districts													
Preliminary Punjab Cancer Data Analysis													
iHRIS testing													
Finalization of dissertation topic													
Customization of DHIS Hospital for NIKDU Hospital Bangladesh													
Creation of testing checklist													
Testing DHIS Hospital for NIKDU Hospital													
Requirements gathering for District Rampur and Kinnaur													
Preparation of SOPs for NIKDU Hospital													
Report preparation													
First draft of dissertation report													
Finalization of dissertation report													

Part II : Dissertation on '**Customization of DHIS Hospital for NIKDU Bangladesh'**

CHAPTER 1

1.1 Introduction

Information systems can be customized according to the specific requirements of a hospital. A hospital can tell the solution provider its needs and the applications can then be moulded to deliver exactly what was demanded.

Even if there is a modest increase in cost, the benefits of having a tailored solution in terms of future time and cost savings will usually offset this quite rapidly.

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The processes and working of hospitals in Bangladesh is quite different from those in India. It is important to understand these nuances and incorporate them into the information system for maximum user satisfaction and implementation success.

Government of Bangladesh plans on implementing DHIS HOSPITAL in all Government run hospitals in Bangladesh over a period of time. However, initially, the same will be implemented in three hospitals namely, National Institute of Kidney Diseases and Urology (NIKDU), Government Employee Hospital (GEH) and Mother and Child Health Tracking Institute (MCHTI). This study was conducted in NIKDU, Bangladesh.

1.2 Literature review

The International perspective :

1) **Hospital Based Customization of a Medical Information System**

Marilyn A. Rath and Julie C. Ferguson

Hospital-based customization provides a means of achieving timeliness with maximum user satisfaction. It, however, requires a major commitment in personnel time as well as additional software and training expenses. Hospital based customization of an MIS requires a major commitment in personnel time as well as additional software and training expenses.

However,the enhanced control of system modifications and overall flexibiity in plannning the change process result in enthusiastic support of this approach by many hospitals. The key factors for succes include careful selection of local personnel with adequate vendor support, extensive QA control, thorough auditing/validation and direct user involvement.

2) Enhancements in healthcare information technology systems: customizing vendor-supplied clinical decision support for a high-risk patient population.

Tiwari R, Tsapepas DS, Powell JT, Martin ST

Healthcare organizations continue to adopt information technologies with clinical decision support (CDS) to prevent potential medication-related adverse drug events. End-users who are unfamiliar with certain high-risk patient populations are at an increased risk of unknowingly causing medication errors. After review of 4692 potential tacrolimus-based DDIs between 329 different drug pairs supplied by vendor CDS, the severity of 20 DDIs were downgraded and the severity of 62 were upgraded. The need for institution-specific customization of vendor-provided CDS is paramount to ensure avoidance of medication errors.

3) Electronic medical record customization and the impact upon chart completion rates.

Bennett KJ, Steen C

Abstract

The study's objective was to determine if alterations to the utility of an existing electronic medical record (EMR) application resulted in an improvement in clinical operations. They altered several templates within an existing EMR application to improve ease of documentation of clinical encounters. They discovered that the template changes resulted in an increase in the number of charts completed within 30 days by nearly 5%, resulting in a substantial number of billable clinical encounters.This improvement is important, as compliance policies prohibit the billing of encounters if the chart is not completed within 30 days. We conclude that simple, inexpensive changes in existing technology may be adequate to have a significant impact upon an organization.

1.3 Objective

General objective :

To study the process of customization of DHIS Hospital NIKDU, Bangladesh.

Specific Objectives :

- Customization of DHIS Hospital according to the hospital requirements.
- Testing DHIS Hospital according to Bangladesh specific requirements.
- Identifying the gaps in the customization during the testing
- Creating a Testing-Checklist.

CHAPTER 2

DATA AND METHODS

2.1 Site and Time line:

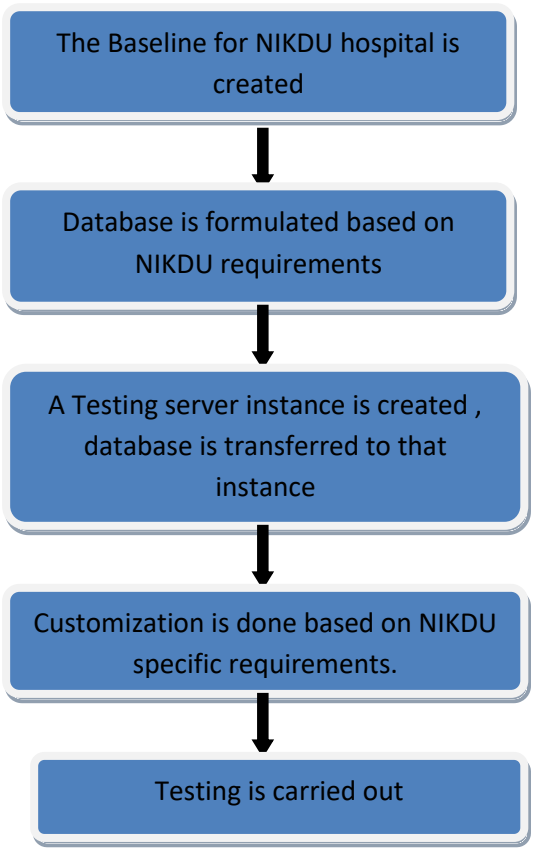
This study was carried out at HiSP India Office from January 7th to April 7th 2013.

2.2 Data Collection Method:

- This was a qualitative study for which the data was collected by reviewing various papers and manuals and also by hands on experience on customization & testing.

2.2 Process of customization for NIKDU Hospital Bangladesh

Customizations include the following aspects:



Process Flowchart for Customization

The OpenMRS Platform

OpenMRS is an application which enables design of a customized medical records system with no programming knowledge (although medical and systems analysis knowledge is required). It is a common framework upon which medical informatics efforts in developing countries can be built.

OpenMRS is for people that need to implement a medical records system. It is both just a library of API calls and a database and a default implementation of those API calls in the form of a web application. OpenMRS is a free, open-source program. All of the core resources needed are open source and freely available. OpenMRS is backed by a data model

driven by a concept dictionary, allowing for the collection of coded, reusable data without requiring changes to the data model. OpenMRS is programmed in Java and the core application works through a web-browser. Hibernate is used as an interface layer to the database. Tomcat is used as the web application server. The back end database is currently in MySQL. The system creates XML schemas for form design. Form design and form data entry is currently done in Microsoft Infopath, HTML, or XForms. When form data entered is submitted, it is converted into a HL7 message before going into the database.

2.3 Bangladesh specific customization

Module Management

Steps for Uploading a module

Step 1*:* To upload a module, log into the HIS as administrator, once you successfully log in, Click on the **"Administration"** menu.

Step2*:* In the Administration Menu, click on **"Manage Modules"**

Figure 2: Administration Screen

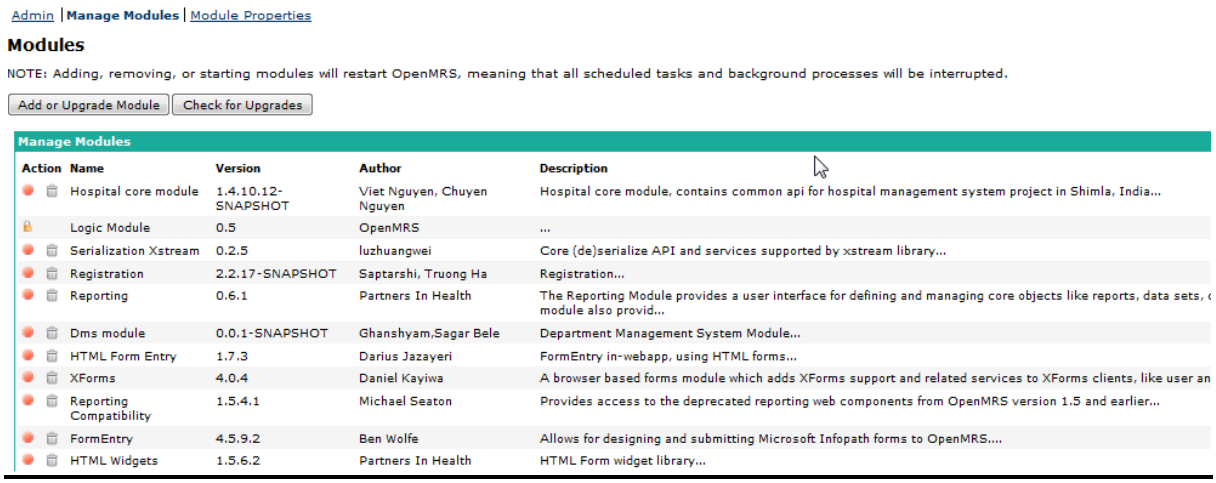


Figure 3: Module Management

Step 3: Click on **"Add or Upgrade Module".**

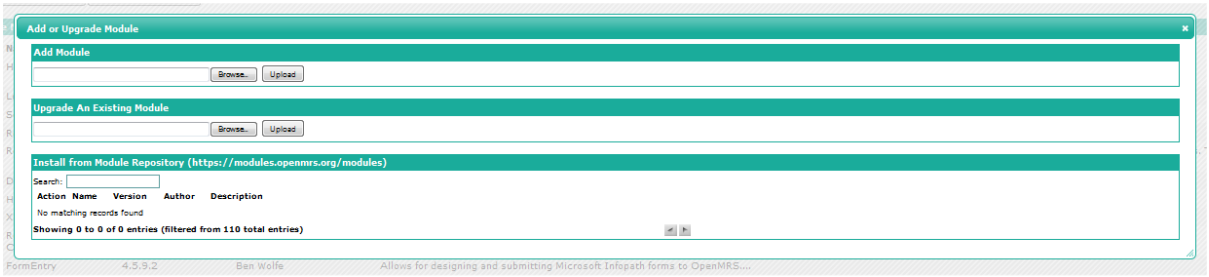


Fig 4: Add/upgrade Module

Step 4: Click on **"Browse"** and search for the ".**omod**" extension file in the system

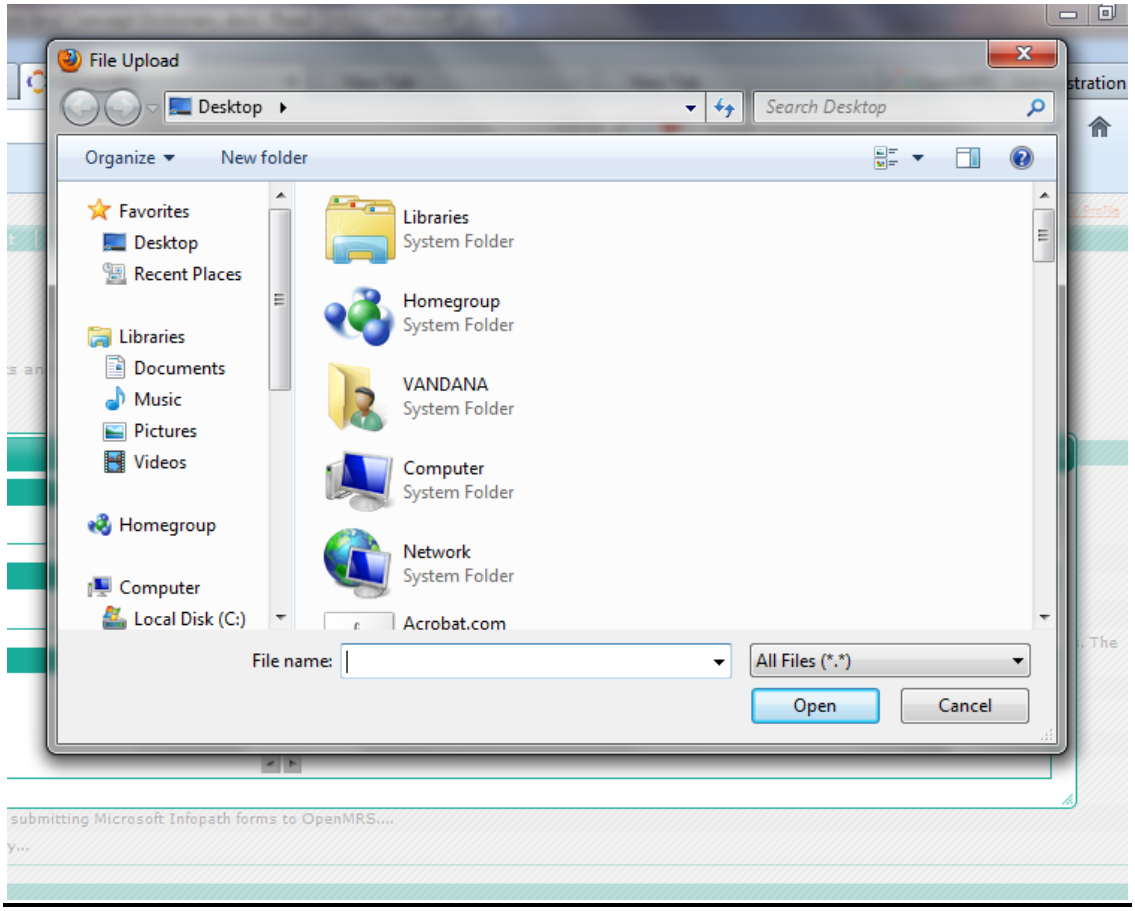


Fig 5: Browse for the **.omod** extension file

Step 5: Select the file and click on **"Open".**

Step 6: Click on **"Upload"** to upload the module.

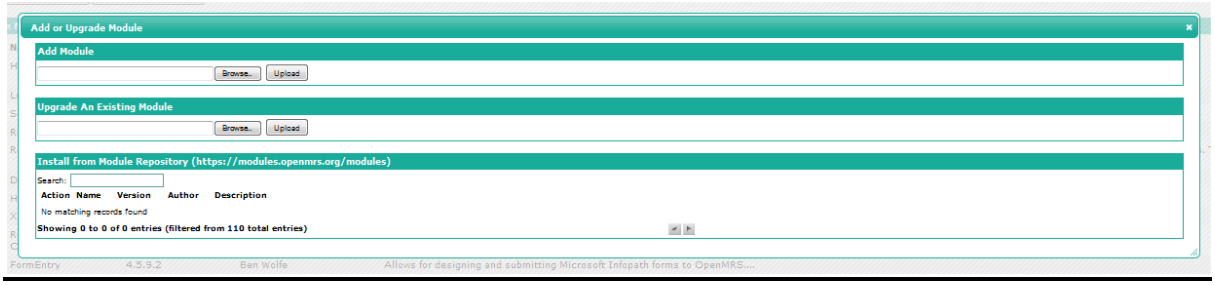


Fig 6: Upload the module

Module Versions

How to know the version of the module?

Step 1*:* To know the version of the existing modules, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step2*:* In the Administration Menu, Click on **"Manage Modules".**

Once you click on the Manage Module option, the list of all the existing modules uploaded is displayed, with their respective Version Number.

What is Custom Branding?

Custom Branding is a module that allows changing logos in the application such as main page logo, the top icon and top left text can all be changed through this module.

Steps for changing the Branding

Step 1*:* For customizing the branding you need to upload the Custom Branding module through "Manage modules" in Administration Menu. (Note: Follow the same steps as mentioned above in the section **"How to Add or Upgrade a new module?"**) Once you have successfully uploaded the module, log into the HIS as an Administrator and click on the Administration link.

Step2*:* In the Administration Menu, Click on **"Change Branding"**

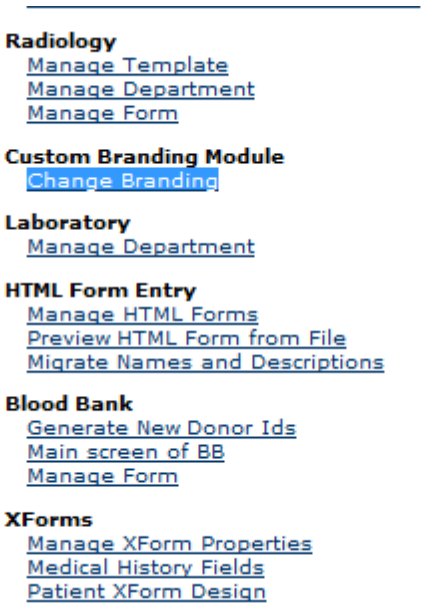


Figure 7: Change Branding on Administration Screen

Step3*:* Change the Default logos and the Text Logo by clicking on **"Browse"** and selecting file.

Step 4*:* Select the appropriate file.

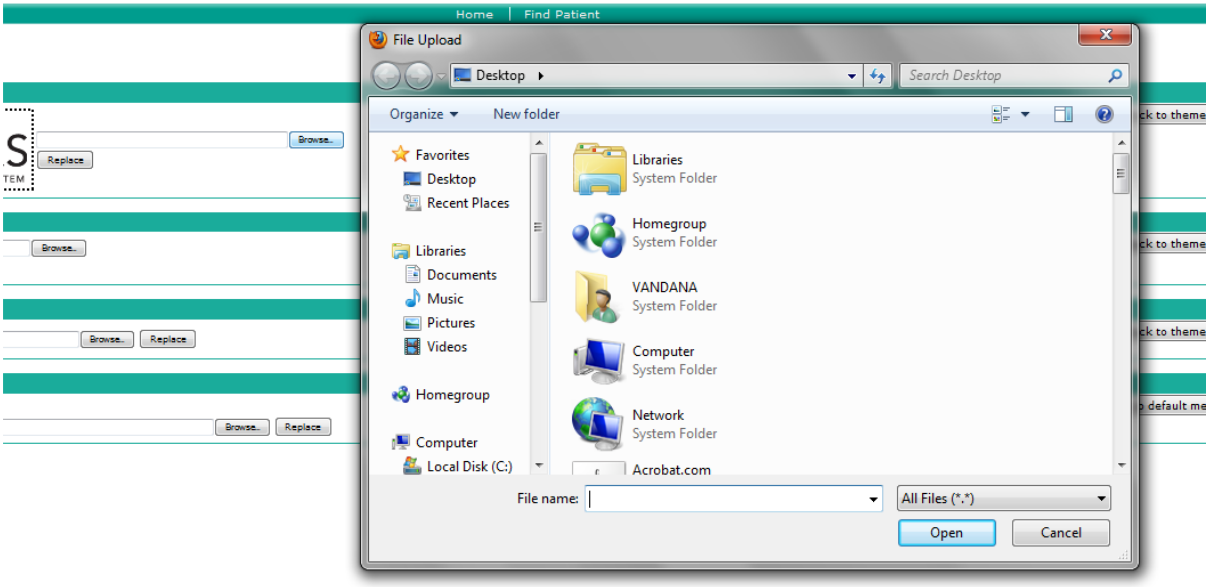


Figure 8: Selecting the file

Step 5*:* Replace the default logos by the selected file by clicking on **"Replace"**

Figure 9: Replacing the logo

Roles, Privileges and User Management

Definitions:

- **Privileges**: Privileges define what can or cannot be done in the system (e.g. Edit People or Add User)
- **Roles:** Roles are used to group privileges into a more manageable grouping in order to make the system easier to manage; roles can contain other roles as well as privileges
- **Users:** Users are the people who will using the system on the basis of the roles and privileges assigned to them. The HIS makes use of the roles to manage permissions. The typical roles associated in the HIS are as follows:

❖ **System Administrator:** Configures DHIS Hospital, installs and updates modules, manage user accounts.

❖ **Registration Clerk/Admin**: Adds new patients to DHIS Hospital at check-in; adds patients to programs.

❖ **Medical Officer/ Consultant**: Creates and updates the encounters after a visit, views patient records at point of care; creates or updates orders or encounters; assigns regimens.

❖ **Billing clerk /Admin**: Adding new bill; editing the bill and voiding the bill.

❖ **Administrator**: adds or changes concepts in the concept dictionary; adds or updates programs

❖ **Nurses**: Adds IPD encounter details of the patient.

❖ **Pharmacy and Inventory Clerk**: Maintains stock of drugs/items; issues drugs/items to patient and IPD‟s.

❖ **Laboratory Technician/ Attendant**: Accepting the patients for tests; entering the patient test report and print the report.

Steps for Adding Privileges

Step 1: To add a privilege, log into HIS as administrator and click on the **"Administration"** menu link.

Step 2*:* In the Administration Menu, click on "Manage Privileges".

Step 3*:* In the Privilege Management Screen, click on **"Add Privileges"**

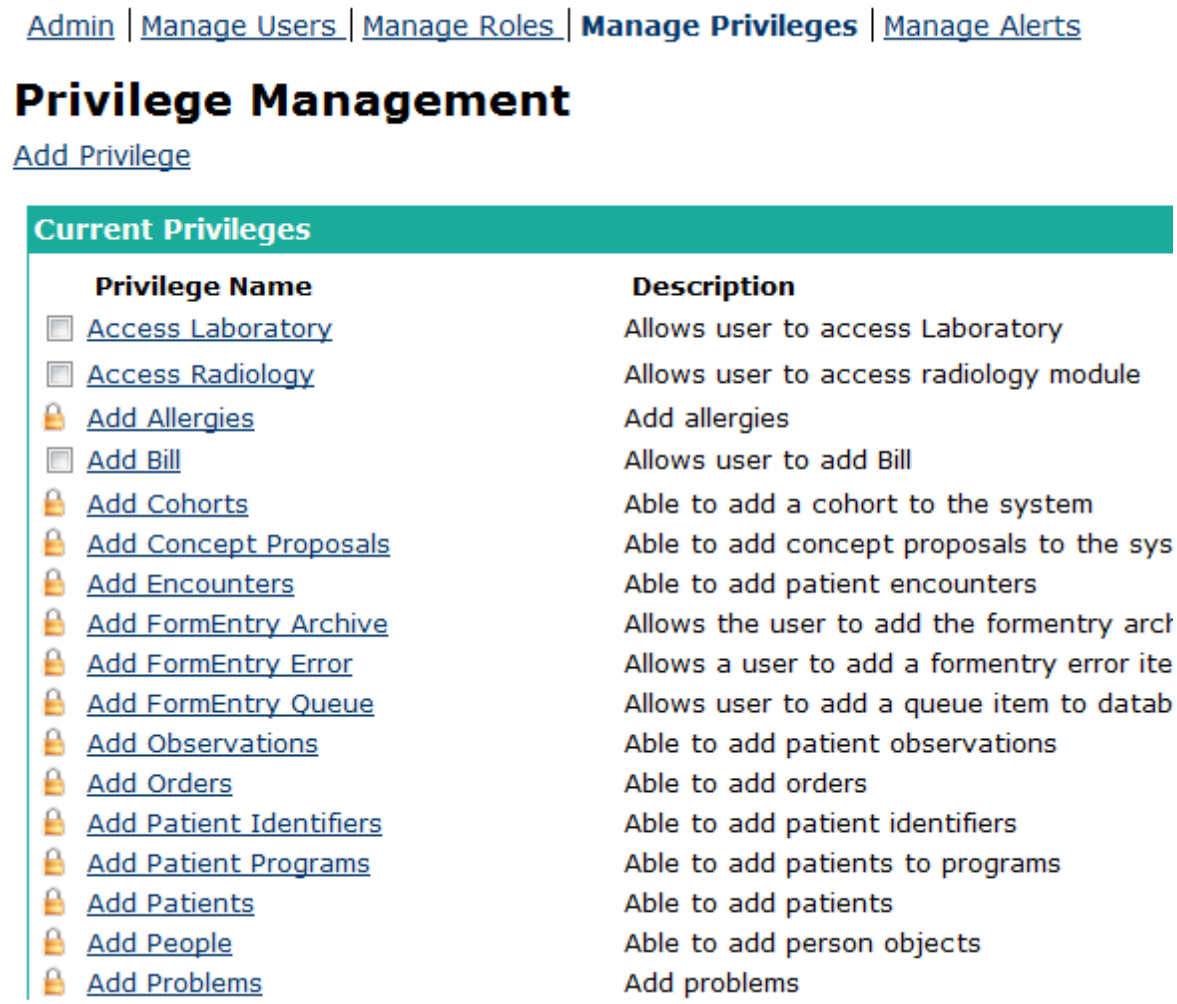


Fig 10: Privilege Management Screen

Step 4*:* Type the Name and Description of the privilege.

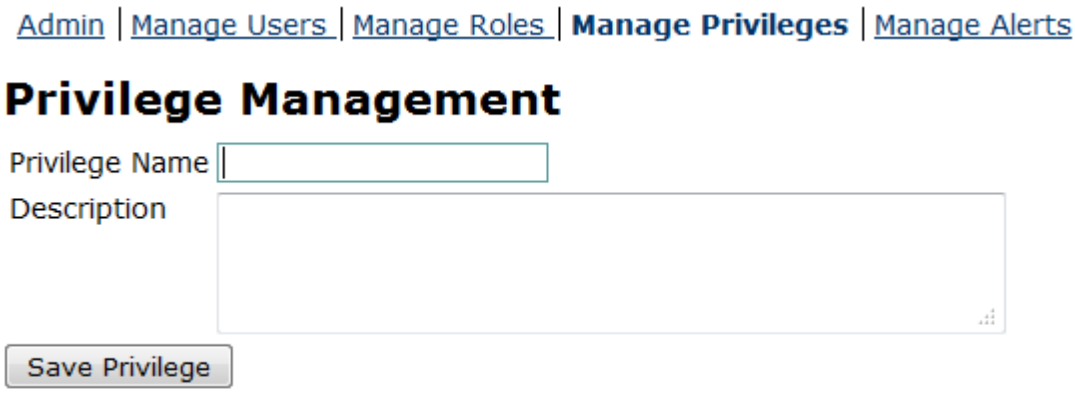


Fig 11: Add Privilege

Step 5*:* Click on **"Save Privilege"** button.

Steps for Adding Roles

Step 1*:* To add a role, log into the HIS as an Administrator and click on the **"Administration"** menu link.

Step 2*:* In the Administration Menu, click on **"Manage Roles"**

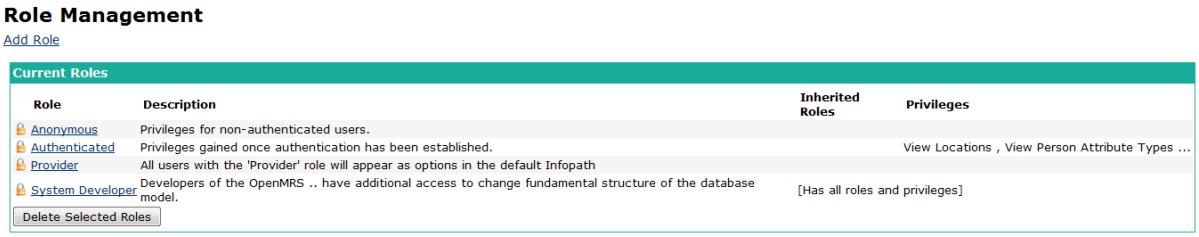


Fig 12: Role Management Screen

Step 3: Click on **"Add Role"**

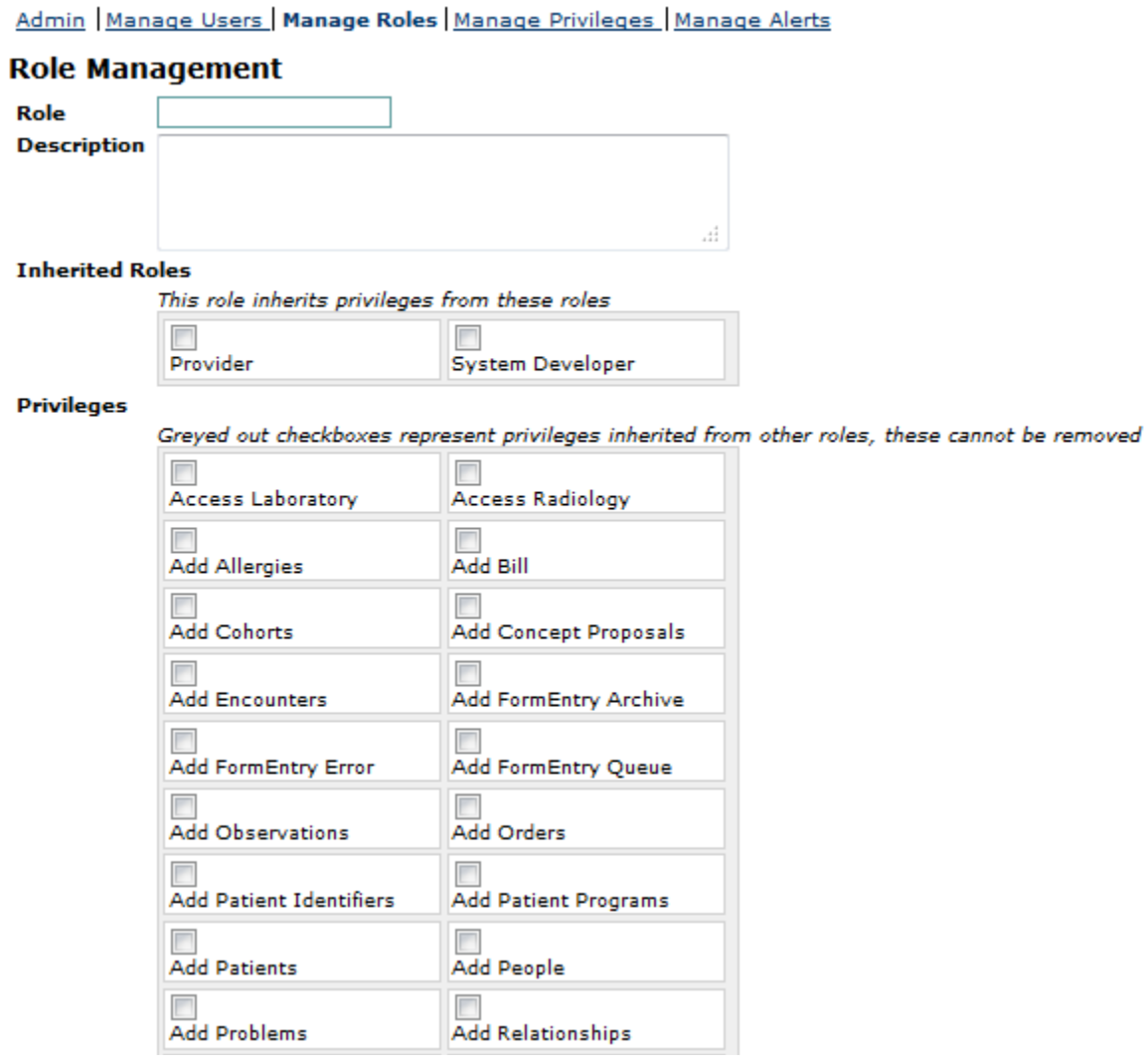


Fig 13: Create/Edit Role

Step 4: Type the Name of the Role.

Step 5: Type the Description for the Role.

Step 6: Select the Inherited Role

(A Role is just an aggregate of Privileges. Users contain a number of roles (Users DO NOT contain any privileges directly). Roles can be grouped by inheriting other roles. If a user is given Role A that inherits from Role B, the user has all rights/abilities for both Role A's privileges and for Role B's privileges. Role A= Role B+ Additional Privileges (Extra rights/abilities) For E.g. Registration Administrator can do what a Registration clerk does + Edit patient‟s details (Extra right/ ability))

Step 7: Select Privileges which have to be assigned to that role.

Step 8: Click on "Save Role" button.

Steps for Adding Users

Step 1*:* To add a user, log into HIS as an administrator and click on the "**Administration**" menu link.

Step 2: In the Administration Menu, click on **"Manage Users".**

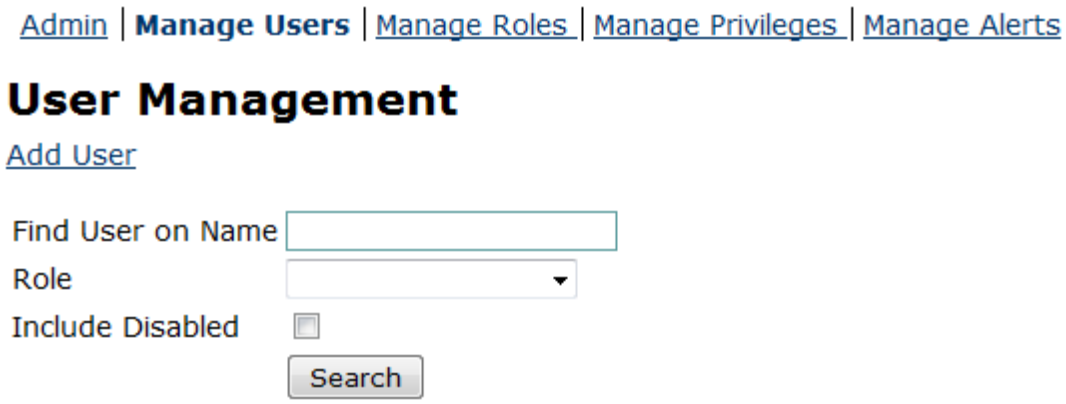


Fig 14: User Management Screen

Step 3: Click on **"Add User".**

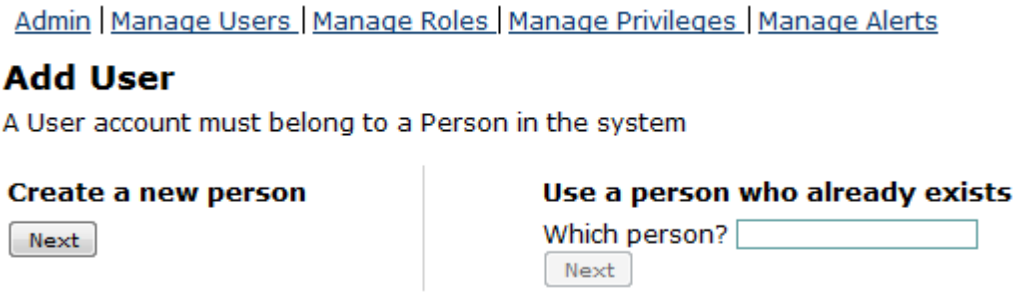


Fig 15: Add/ Search User Screen

Step 4: Click on the **"Next"** button under **"Create a new person"**

Step 5: Click on **"Save User"** button to add the person.

REGISTRATION

Registration is the first encounter of the patient coming to the hospital. There are three registration points in NIKDU.

- **Urology:** There are 3 counter in there and registration time is from 8 am to 1 pm.
- **Nephrology:** There are 3 counter in there and registration time is from 8 am to 1 pm.
- **Emergency** (covered separately)

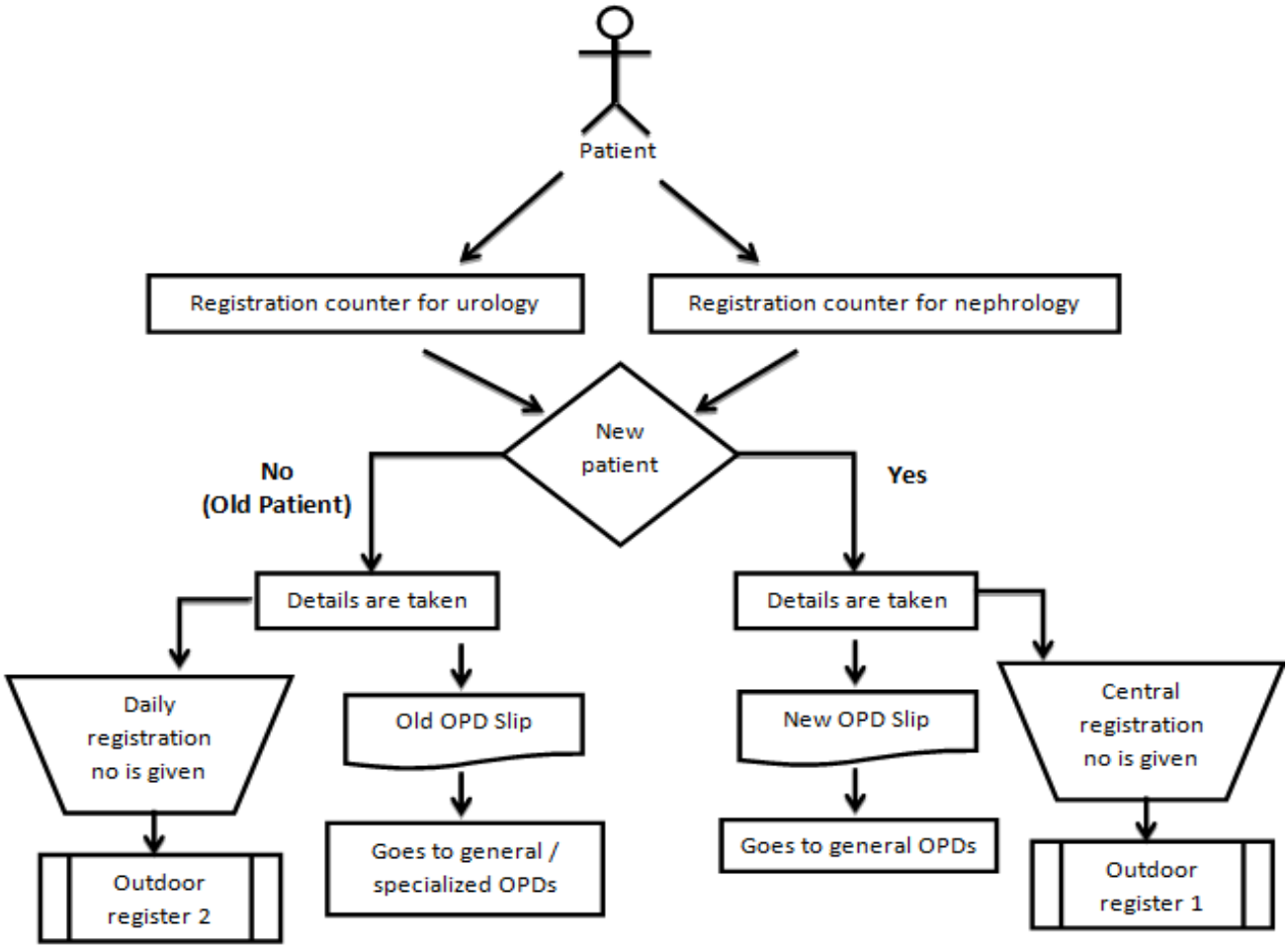


Figure 16: Process Flow explaining Registration

The patient comes to the registration counter which is located at the entrance of the hospital. Separate registers are maintained for urology and nephrology. There are separate registers maintained for both old and new patient in each register point. Every new patient is given a unique identifier.

Any new patient is given a daily Serial Number along with a unique identification number which composes of a/b/c where a is the yearly serial number, b is the month and c is the year.

Each old patient get a new daily serial. Both new or old patient have to visit the registration counter everytime the patient comes to the hospital. Any patient who is referred from outside for a laboratory tests also visits the registration counter and visits the MO.
The **customization** of the Registration Module includes the following:

Person Attributes

Person attributes are the attributes of a person such as the demographic details of the person such as Name, Relatives Name, Patient Category, Contact Number etc. that help in identification of the patients from the patient pool. In Bangladesh hospitals, there are no patient categories on the registration menu, however, the billing administrator can add a bill for a patient that is either payable or free.

Identifier Initial

Identifier Initials are the abbreviation or the initials of the hospital name and it can be changed according to the name of the hospital.

How to manage Identifier Initials?

The Identifier Initials can be changed according to the hospital and its name. The following steps allow the user to manage the identifier:

Step 1: To manage Identifier Initials log into the HIS as administrator, once you successfully log in, Click on the **"Administration"** menu link.
Step 2*:* In the Administration Menu, **click on** "**Manage Global Properties**" under "**Maintenance"** section.
Step 3: Locate the „**registration.identifier_prefix"** in the Manage Global Properties list and type in the desired initial for the identifier.
Step 4: Save by clicking "Save" at the end of the page

Customization of the Referral Information (Referred From)

Step 1: A concept called **Patient Referred from** is created of which the class is question and data-type is coded.
Step 2: The institutions from where the patient is referred from is mapped as answers to this concept. The answers are concepts themselves.

Customization of the Referral Information (Referral Type)

Step 1: A concept called **Reason for Referral** is created of which the class is question and data-type is coded.

Step 2: The various reasons for referrals are mapped as answers to this concept. The answers are concepts themselves.

Customization of the OPD Room to visit

Step 1: A concept called **OPD Ward** already exists in the database (Class is question and data-type is coded).

Step 2: The various OPDs are mapped as answers to this concept. The answers are concepts themselves.

Department Management System Interdependency (with Registration Module)

In case the OPD is associated with a Unit that functions at the specific day of the month then, we use the DMS Module along with Registration. It has the following steps:

Step 1: Select DMS from the navigation menu and click on "Activate Unit"

Step 2: Select the name of the OPD that is functional on the particular day and activate it

Similarly, a unit can be deactivated by clicking on "Deactivate Unit"

BILLING

The Billing module deals in collection of money for services availed by a patient and other services available at the hospital for a cost they include:

- Money collected in cash for outpatient services availed.
- Money collected in cash for inpatient services availed.
- Other services like Ambulances, tenders, blood bank, fee for medical examinations.

The following elements are involved in the customization of the billing module:

Billing Hierarchy

Billing Hierarchy is created in the concept dictionary. One of the prerequisite for creating a billing hierarchy is creation of concepts for all the services to be included in the hierarchy. The Steps for creating Billing Hierarchy in Concept Dictionary are as follows:

Step 1: To create billing hierarchy, log into the HIS as administrator, once you successfully log in, Click on the **"Dictionary"** menu.

Step2*:* In the Dictionary Menu, find concept **"Services Ordered"**(Class and data-type is Question Coded).

Fig 17: Services Ordered Concept

Step 3*:* Click on **Edit** and map the various services that are to be included in billing hierarchy.

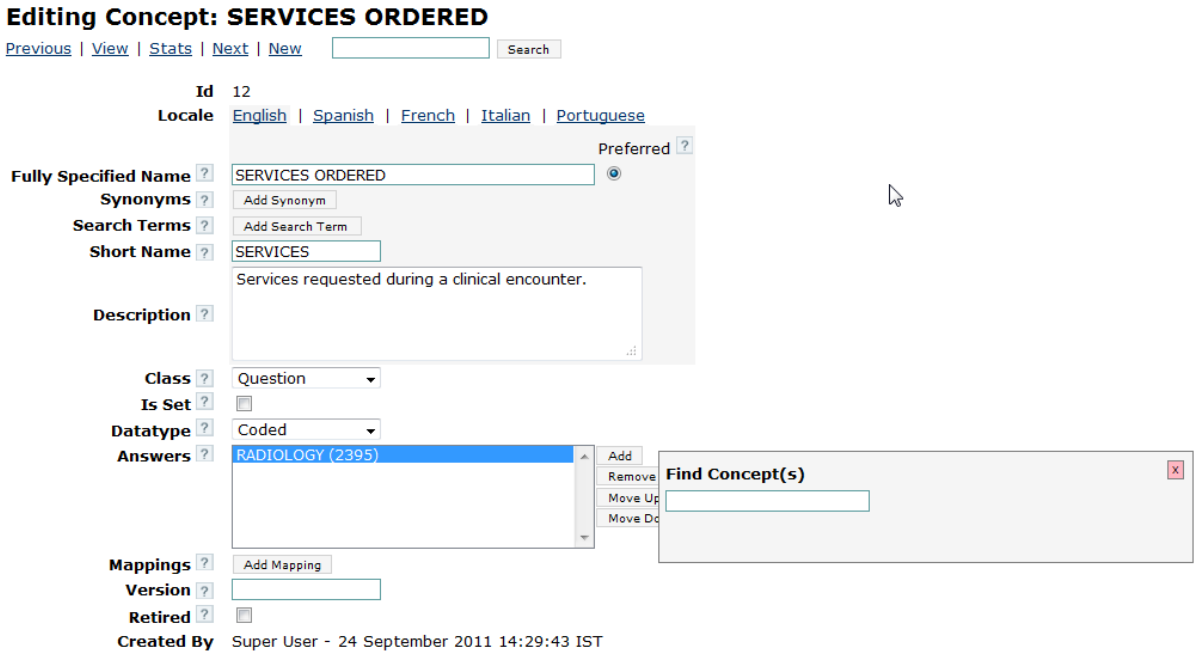


Fig 18: Add/upgrade Services

Step 4*:* Click on **"Save"** to save the hierarchy.

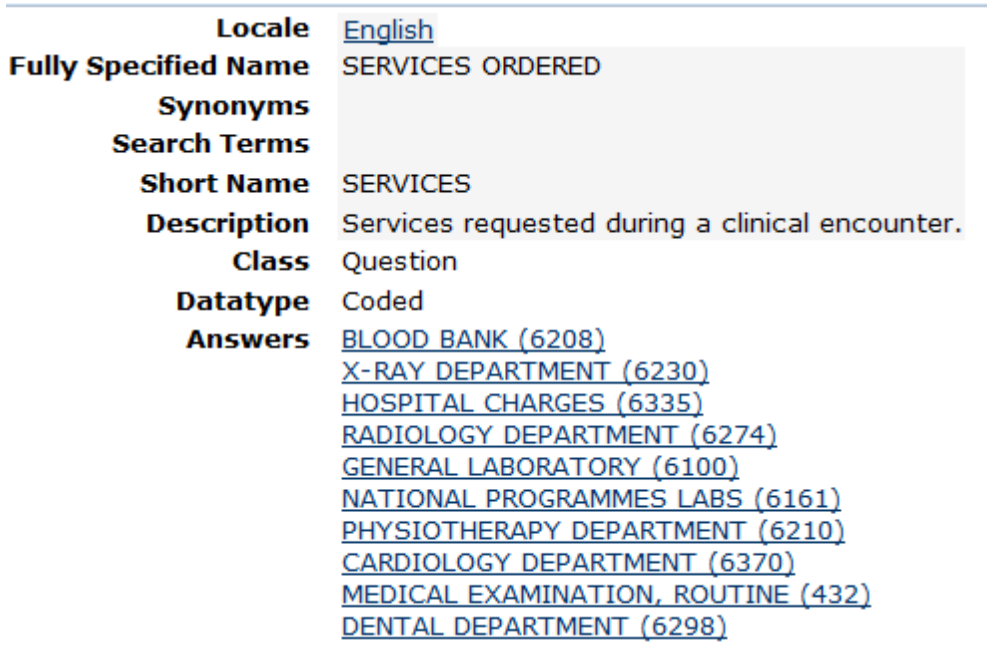


Fig 19: Billing hierarchy under Services Ordered

Manage Billable Services

This functionality helps to add prices to Investigations/Diagnostics. The followings steps are followed in order to add prices:

Step1: To add price, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step2:In the Administration Menu, Click on **"Manage Billable Services".**

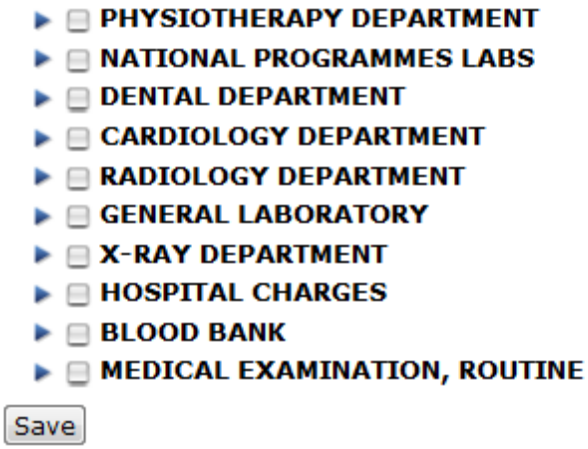


Fig 20: Billing Hierarchy

Step3: Now click on the arrow Near the Investigation Name and a Drop Down of procedures under that department available in the Hospital will appear. Now enter a Price for the procedure and press the same button and then click on **"Save"**.

Update Service Category

Update Service category is an Important Functionality. Whenever we add a new service like Ambulance, Tender, Company Driver or make changes in the Billable services for which a user charge is levied it is important to Update Service category. The following steps have to be followed to update service category:

Step 1: After adding new services or prices in billable services go to **"Administration".**
Step 2: Click on **"Update Service Categories"** (it will update all service categories under respective tables in the Data base), listed under Billing.

Manage Ambulances

This functionality helps to view, add and remove Ambulances. The following steps have to be followed in order to view, add, and remove ambulances.

Step 1: To add ambulance, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step 2*:* In the Administration Menu, Click on **"Manage Ambulances".**

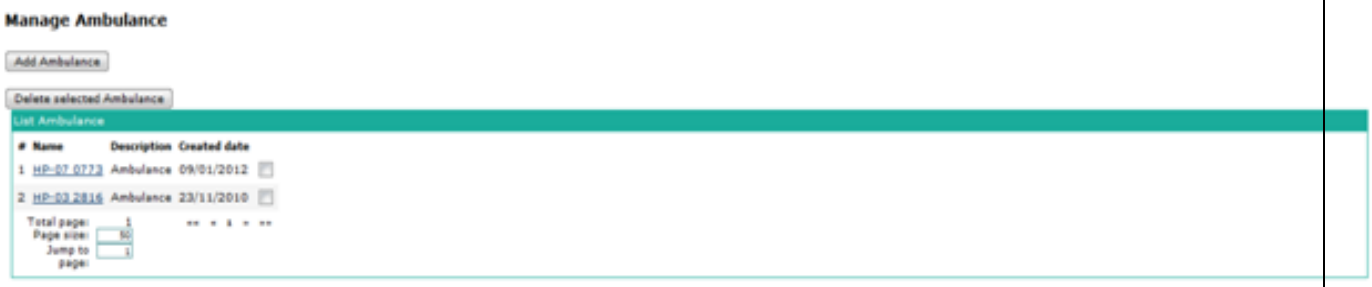


Fig 21: Manage Ambulance Screen

Step3: The list of current Ambulances will be displayed, to add an ambulance, click on the **"Add Ambulance".**

Step4: Type the name and description of the Ambulance as shown below.

Step5: Click on "**Save"**. The Ambulance will appear on the window of Manage Ambulance after saving.

Step6: By selecting the name of the ambulance the user can edit the name and description of the ambulance and then you save it.

Step7: To delete an ambulance, click on the **"check box"** and click on" **Delete Selected Ambulance".**

Step8: After that Ambulance will disappear from the list of Manage Ambulance as shown in the window below and it will show the **"Ambulance Deleted**" note on the top of the screen.

Manage Driver

This functionality helps to view and add drivers. The following steps have to be followed in order to view, add and delete drivers.

Step 1: To add driver, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step2:In the Administration Menu, Click on **"Manage Drivers".**

Step 3: List of current drivers will be displayed, to add new driver user have to click on add new driver tab.

Step 4: Type the details of the driver that you intend to add.

Step 5: Click on **"Save".** The driver will appear on the window of Manage driver after saving.

Step 6: Select the name of the driver to edit the name and description of the driver.

To delete the driver click on **"Check box** "which is after created date, and then click on **"Delete selected drivers"**

Step 8: After that driver will disappear on the window of Manage driver and it will show the note on the top of the screen.

Manage Company

This functionality helps to view, add and remove Company. The following steps have to be followed in order to view, add and delete company.

Step 1: To add company, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step2: In the Administration Menu, Click on **"Manage Company".**

Step 3: List of current companies will be displayed, select the name of the company to edit the name and description of the company.

Step4: Click on **"Save".** The Company will appear on the window of Manage Company after saving.

Step 5: Selecting the name of the company, to edit the name and description of the company and then save it.

To delete the company click on **"Check box"** this is after created date, and then click on the **"Delete selected companies".**

Manage Tender

This functionality helps to view, add and remove Tender. The following steps have to be followed in order to view, add and delete Tender.

Step 1: To add tender, log into the HIS as **Administrator** and click on the **"Administration "** menu.

Step 2*:* In the Administration Menu, Click on **"Manage Tender".**

Step 3: List of current companies will be displayed, to add new Tender click on the "**Add new Tender**"

Step 4: Type the details of tender like Number, Name, Description, Price, Opening date and Closing Date

Step 5: Click on **"Save"**, the Tender will appear on the window of Manage Tender after saving.

Step 6: To delete the Tender click on the **"Check box"** this is after created date, and then click on the **"Delete selected Tenders"**

Step 7: After that company will disappear on the window of Manage Company and it will show the note on the top of the screen

Manage Miscellaneous Services

This functionality helps to view, add and remove miscellaneous services. The following steps have to be followed in order to view, add and remove miscellaneous services.

Step1: To add miscellaneous services, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step2*:* In the Administration Menu, Click on **"Manage Miscellaneous Services".**

Step3: The entire current miscellaneous service list will be displayed, to add new miscellaneous service click on **"Add miscellaneous service"**

Step4: Type the details of service that is to be added.

Step5: Click on **"Save".** The Service will appear on the window of Manage miscellaneous service after saving

Step6: To delete the service click on the **"Check box"** this is after created date, and then click on **"Delete selected Miscellaneous Services"**

Step7: After that service will disappear on the window of Manage miscellaneous service and it will show the note on the top of the screen.

Out Patient Department

There are two departments having two OPDs each in the hospital-

- **Urology**
- General OPD
- Specialized OPD

- **Nephrology**
- General OPD
- Specialized OPD

The OPDs function on a unit-wise basis meaning that everyday a unit (Consultants and Medical Officers) runs the indoor and the outdoor depending on days of the week. The following table specifies the days and their units:

Department	Sub-departments	Unit	Days
Urology	Male Urology	Yellow	Sunday, Tuesday, Thursday
	Female Urology		Saturday, Monday, Wednesday
	Transplant Urology	Green	

	Paediatric Urology		
Nephrology	Male Nephrology	Unit 1	Saturday, Tuesday
	Female Nephrology	Unit 2	Sunday, Wednesday
	Paediatric Nephrology	Unit 3	Monday, Thursday

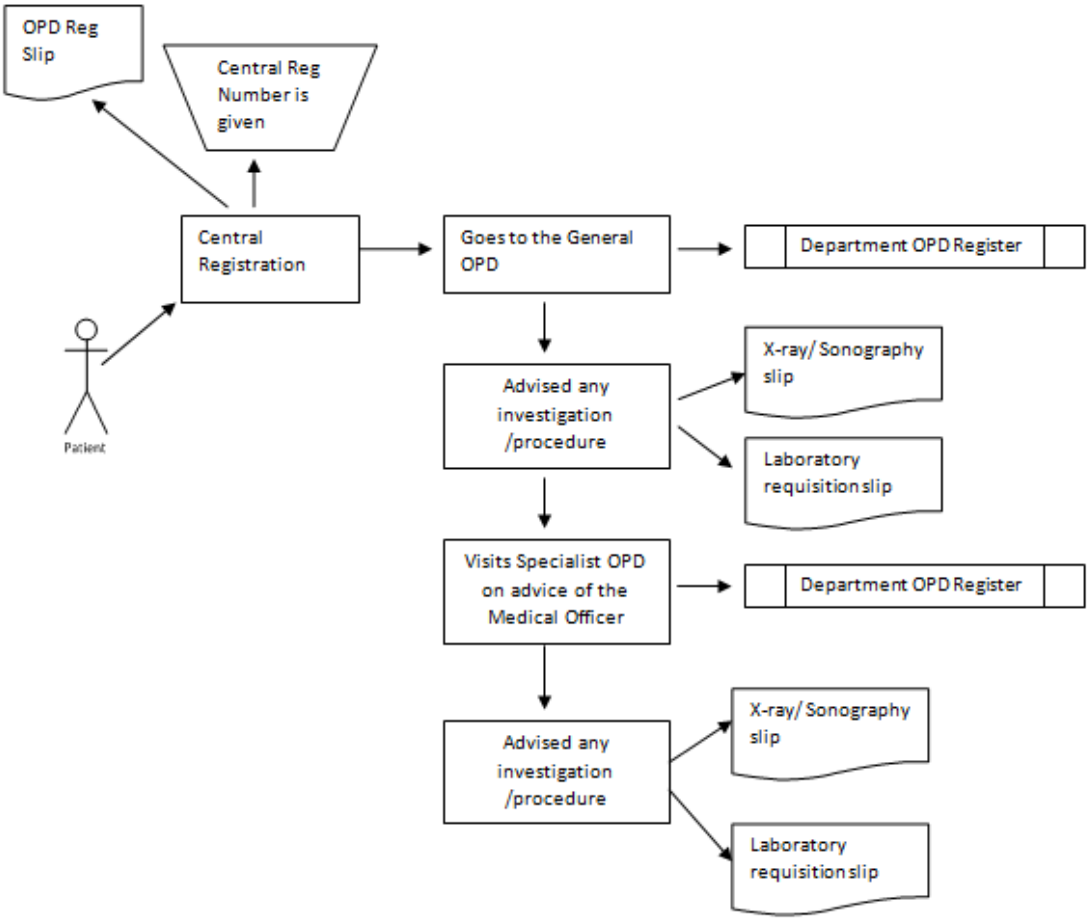


Fig 22 Process Flow of OPD

The patient after receiving a ticket from the registration counter is directed to the **General OPD handled by the Medical Officer** on duty. Here the first screening of the patient is done and a provisional diagnosis is written on the slip of the patient.

 In case of requirement of specialized treatment, the Medical Officer refers the patient internally to the **Specialized OPD handled by the Consultant.**

 If the doctor has to advice at any stage for Laboratory tests and Radiological investigations, the doctor stamps the tests (Laboratory) and writes the radiological tests on the prescription slip of the patient.

 The medication is written on the prescription of the patient (retained by the patient) and also written on another printed slip for the dispensary to give drugs to the patient. This slip is retained by the pharmacist.

The OPD Module involves the following customizations:

Mapping the OPDs in Concept Dictionary

To begin with, the OPDs have to be mapped in the Concept Dictionary; the following steps are followed to do the same:

Step 1: To add OPD's, log into the HIS as administrator, once you successfully log in, Click on the **"Dictionary"** menu.

Step2*:* In the dictionary, search the concept **"OPD Ward"** which already exists in the database (Class is question and Datatype is coded).

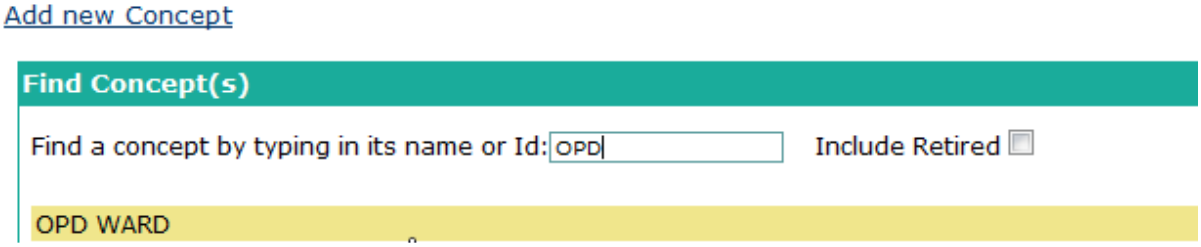


Fig 23: Search OPD Ward

Step3: Click on **"Edit"**, and map the various OPD's as answers to this concepts.

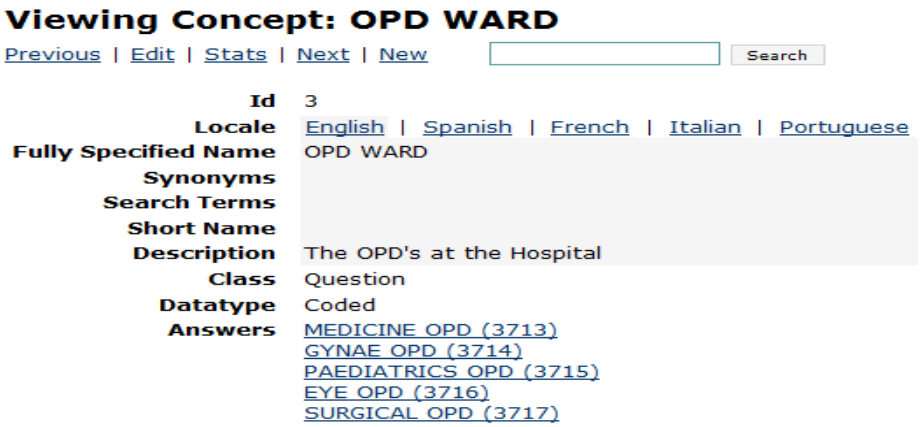


Fig 24 : Mapping OPDs

Step4: Click on **"Save"** to save the concept.

Manage OPD Department

The next customization level of OPD module includes mapping of the department list so that they appear in their modules. This functionality of Department list enables the OPD user to add the various departments in their module.

The following steps have to be followed in order to map the departments so that they appear in the OPD module

Step 1*:* To add OPD Departments, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step2*:* In the Administration Menu, Click on **"Department List".**

Step3: To add new department click on "**Add Department"**.

Step4: It is important here to check the department that you want to create already exists in not. Check the list of departments that already exist or not. If the department that you want to create doesn't exist click on the **"Add department"**

Step5: Type the name of the department, e.g. Medicine OPD, then select from list that particular OPD (this list is made while preparing the database) and then select retired or not (i.e. the particular concept exists in the database or not.)

Step6: Click on **"Save".** The department that has been created will appear on the following screen.

In-Patient Department

The In-patient department is meant for managing patients who need extended care and have to be kept under observation. Similar to OPD module, the IPD module also has a queue for patients who have been advised admission and an index for already admitted patients. The IPD Module involves the following customizations:

Mapping the IPDs in Concept Dictionary

To begin with, the IPDs have to be mapped in the Concept Dictionary; the following steps are followed to do the same:

Step 1*:* To map IPD's, log into the HIS as administrator, once you successfully log in, click on the **"Dictionary"** menu.

Step2: In the dictionary, search the concept **"IPD Ward"** which already exists in the database (Class is Question and Datatype is Coded).

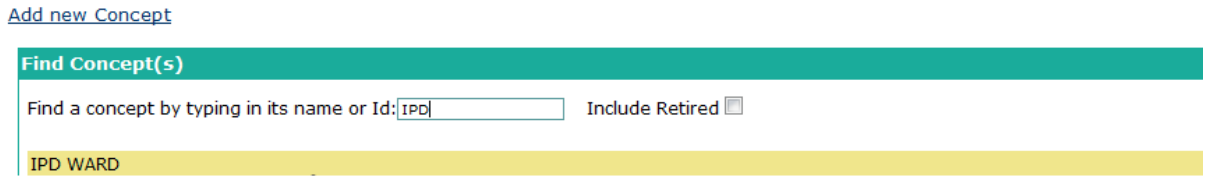


Fig 25: Search IPD Ward

Step3: Click on **"Edit"**, and map the various IPD's as answers to this concepts.

Step4: Click on **"Save",** to save the concept.

Manage IPD Department

The customization of the IPD module allows for mapping of the department list so that all departments appear in their modules. This functionality of Department list enables the IPD user to add the various departments in their module. The following steps have to be followed in order to add departments:

Step 1: To add IPD Departments, log into the HIS as **Administrator** and click on the **"Administration** "menu.

Step2: In the Administration Menu, Click on **"Department List".**

Step3: To add new department click on "**Add Department".**

Step4: It is important here to check the department that you want to create already exists in not. Check the list of departments that already exist. If the department that you want to create doesn't exist click on the **"Add department"**

Step5: Type the name of the department like Female Ortho Ward, and then **"select"** from list the particular OPD (this list is made while preparing the database) and the select retired or not (i.e. the particular concept exists or not in the database.)

Click on Save.

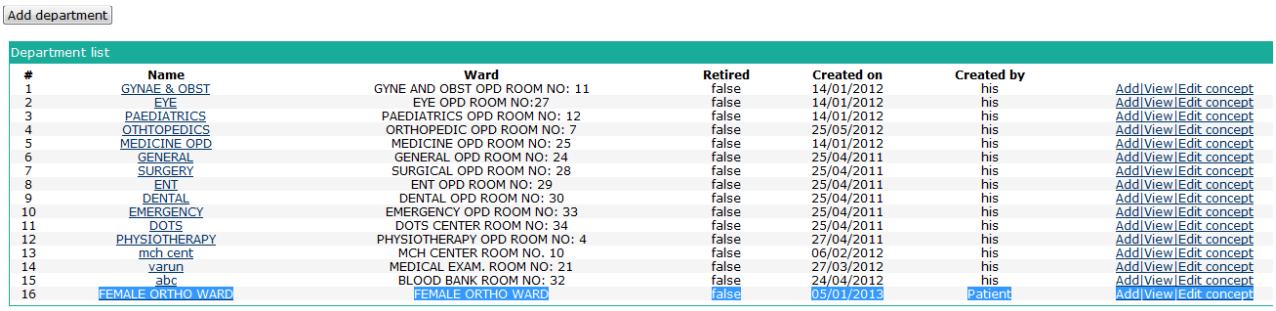


Fig 26: IPD department List

Adding Diagnosis and Procedures to OPDs & IPDs

The next level of customization is adding Diagnosis and Procedures to OPDs and IPDs. The following steps have to be followed in order to do that:

Step 1: To add diagnosis, log into HIS as administrator and click on the **"Administration"** menu link.

Step 2*:* In the Administration Menu, click on "**Department list**" under **"Hospital Core Section"**.

Step 3*:* In Manage Department Screen, click on **"Add/View/Edit Concept"**

Step 4*:* Select the **"Diagnosis and Procedures"** to be added for the particular OPD or IPD and Click on **"Save".**

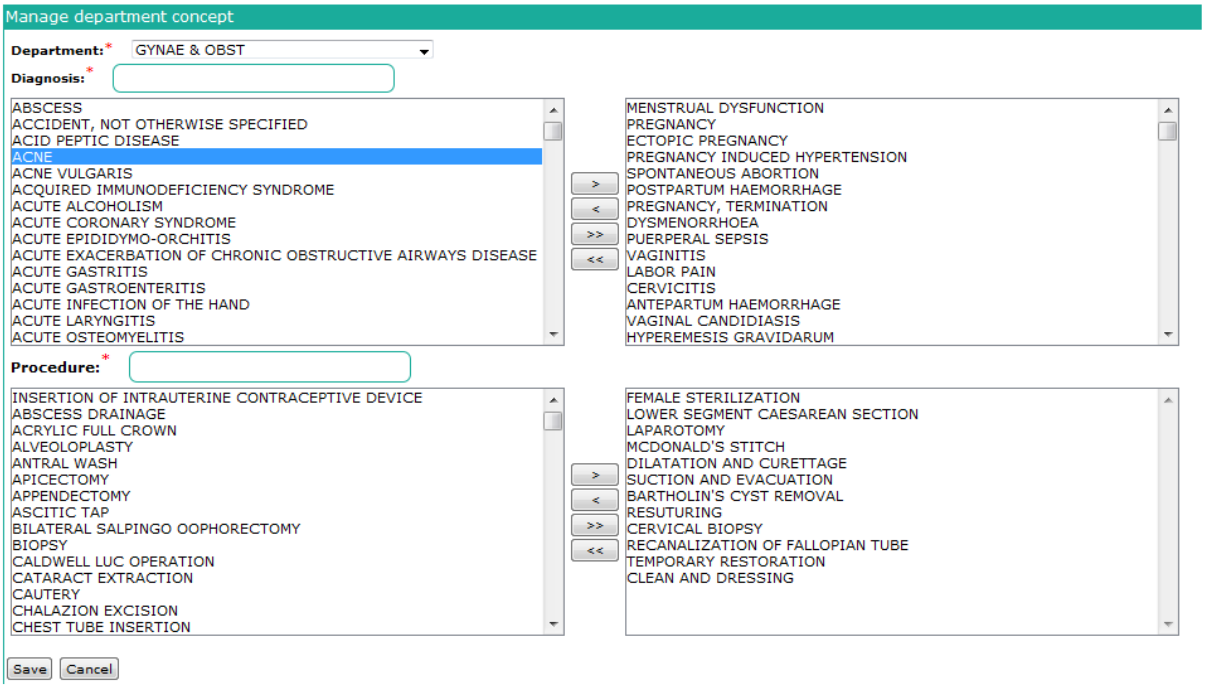


Fig 27: Manage Department Concept

Inventory and Pharmacy Module

The Inventory / General store is the main store at a Public Hospital. All Receipts come to this Main Store and from here items are dispensed to sub stores on the basis of the indent order raised by the Sub-stores. Hospital Pharmacy under online Pharmacy module will be based on drugs /medicines available in medical store/inventory. Patient who is prescribed medicine/drug by the doctor in OPD will come to Pharmacy. If the medicines/drugs are available in pharmacy the patient will be given the advised dosage and an online entry will be made. Pharmacy stock will be updated automatically after each disbursement. The Stock of drug/medicines in Pharmacy will be linked to inventory /Main store and each can see the stock position of available drugs/medicine .Based on the stock position indent for required stock can be made.

The two mainstores are

- General Store
- Surgical Store

Substore :

- Pharmacy

The Hospital has a pharmacy. It is not outsourced. One Pharmacy outlet for outdoor patients exists in the hospital. Indoor and Emergency patients get drugs from indoor nurses and Emergency Medical Officers.

The customization of Inventory and Pharmacy module of DHIS Hospital includes:

- Adding Drugs as Concepts in the Concept Dictionary
- Mapping of each drug in the Manage Concept Drug
- Manage Store
- Manage Item
- Manage Drug

Adding Drugs as Concepts in the Concept Dictionary

As it was iterated before, DHIS Hospital runs on concepts which are built in the Concept Dictionary, similarly the drugs also have to be added as concepts in the Concept Dictionary before any further details can be added to each drug. To begin with, the drugs have to be added in the Concept Dictionary; the following steps are followed to do the same:

Step 1: To add drugs, log into the HIS as administrator, once you successfully log in, Click on the **"Dictionary"** menu.

Step2*:* After click on the Dictionary menu link, Click on **"Add New Concept"**

Step3: Type the name, description and other details about the drugs; Select the **"Class and Datatype"** i.e. Drug and N/A.

Step4: Click on **"Save"** to save the concept.

Mapping of each drug in the Manage Concept Drug

All the drugs that were added in the Concept Dictionary as Concepts will now have to be mapped in the Manage Concept Drug sections, which aids in Adding New Drugs in the inventory and the pharmacy module later. The following steps have to be followed for mapping drugs:

Step 1: To map the drugs, log into the HIS as administrator, once you successfully log in, Click on the **"Administration"** menu.

Step 2: In the Manage Concept Drug, Click on **"Add New Concept"**.

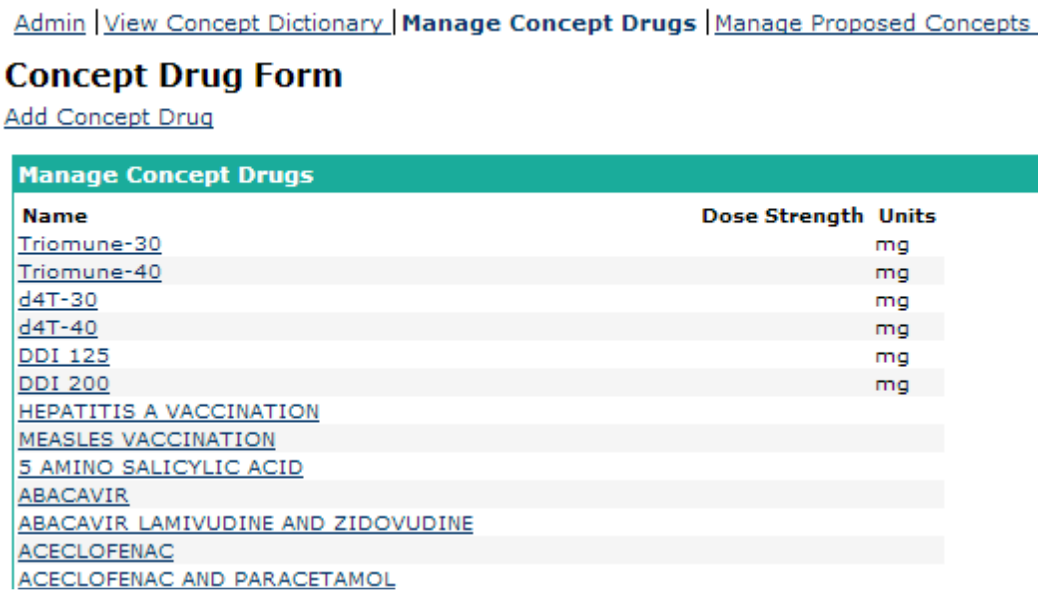


Fig 28: Manage Concept Drug

Step 4: In the Add Concept drug, mention the Name of the Drug, next Search & Select the Concept which was created for the drug in the Concept Dictionary in the previous customization step. Once the right concept is mapped, check the box if the drug is a Combination of two salts, add the Dosage Strength, Units, Minimum and Maximum dose. (All the fields are not mandatory; whatever is applicable shall be filled here).

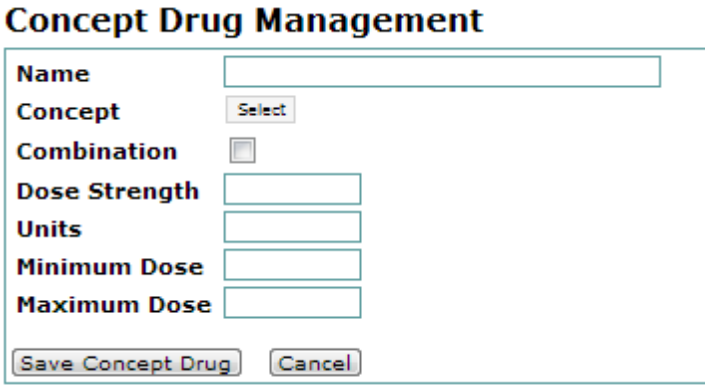


Fig 29: Add Concept Drug

Step 5: After adding all the details, click on **"Save Concept Drug"**

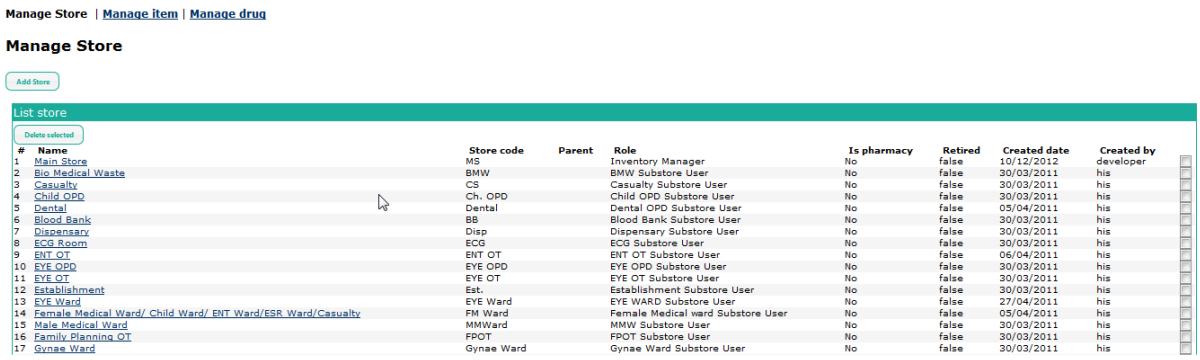
Manage Store

This functionality enables the Inventory manager to create new Stores. The following steps have to be followed in order to add new store:

Step 1: To add OPD's, log into the HIS as administrator, once you successfully log in, Click on the **"Administration"** menu.

Step2*:* In the Administration Menu, click on **"Manage Store".**

Step3: To create a new store Click on "**Add Store"**. It is important here to check the store that you want to create already exists or not. Check the list of stores that already exist. If the store that you want to create doesn't exist click on the add store.



#	Name	Store code	Parent	Role	Is pharmacy	Retired	Created date	Created by
1	Main Store	MS		Inventory Manager	No	false	10/12/2012	developer
2	Bio Medical Waste	BMW		BMW Substore User	No	false	30/03/2011	his
3	Casualty	CS		Casualty Substore User	No	false	30/03/2011	his
4	Child OPD	Ch. OPD		Child OPD Substore User	No	false	30/03/2011	his
5	Dental	Dental		Dental OPD Substore User	No	false	05/04/2011	his
6	Blood Bank	BB		Blood Bank Substore User	No	false	30/03/2011	his
7	Dispensary	Disp		Dispensary Substore User	No	false	30/03/2011	his
8	ECG Room	ECG		ECG Substore User	No	false	30/03/2011	his
9	ENT OT	ENT OT		ENT OT Substore User	No	false	06/04/2011	his
10	EYE OPD	EYE OPD		EYE OPD Substore User	No	false	30/03/2011	his
11	EYE OT	EYE OT		EYE OT Substore User	No	false	30/03/2011	his
12	Establishment	Est.		Establishment Substore User	No	false	30/03/2011	his
13	EYE Ward	EYE Ward		EYE WARD Substore User	No	false	27/04/2011	his
14	Female Medical Ward/ Child Ward/ ENT Ward/ESR Ward/Casualty	FM Ward		Female Medical ward Substore User	No	false	05/04/2011	his
15	Male Medical Ward	MMWard		MMW Substore User	No	false	30/03/2011	his
16	Family Planning OT	FPOT		FPOT Substore User	No	false	30/03/2011	his
17	Gynae Ward	Gynae Ward		Gynae Ward Substore User	No	false	30/03/2011	his

Fig 30: Manage Store

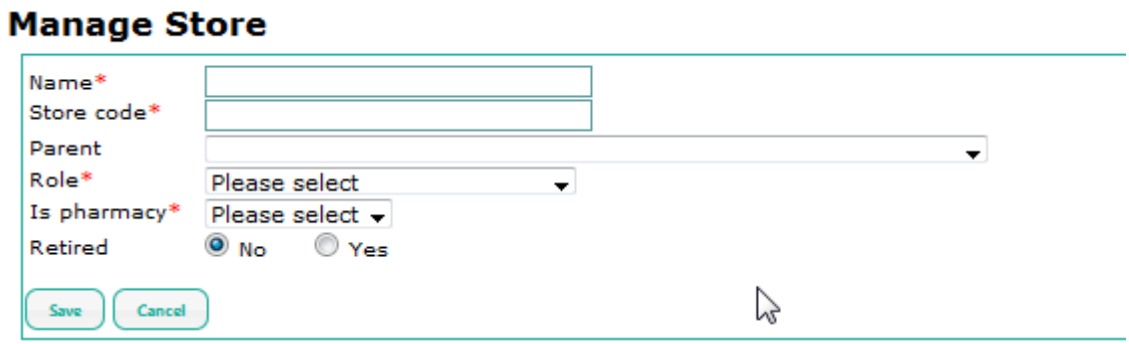


Fig 31: Add Store

Step 4: Type the details i.e. Name of the store, store code and Select the Role of the store (e.g.: Inventory Manager, Pharmacy User, Lab Admin etc.) from the drop down. After selecting the role, if the store is 'Pharmacy' then select YES else NO.

Note: While creating Main store the Parent will be blank, for all other store that we create subsequently ensure to make Main store as the Parent. Only then Main store will serve as recipient of all indents and ensure transfers to respective sub stores.

Step5: Click on **"Save"** and after that it appears in the list of stores.

Manage Items

This functionality enables the Inventory Manager to index a new item. The following steps have to be followed in order to map the items so that they appear in the Inventory & Pharmacy Module:

Step 1: To add OPDs, log into the HIS as administrator, once you successfully log in, Click on the **"Administration"** menu.

Step2: In the Administration Menu, click on **"Manage Item"**

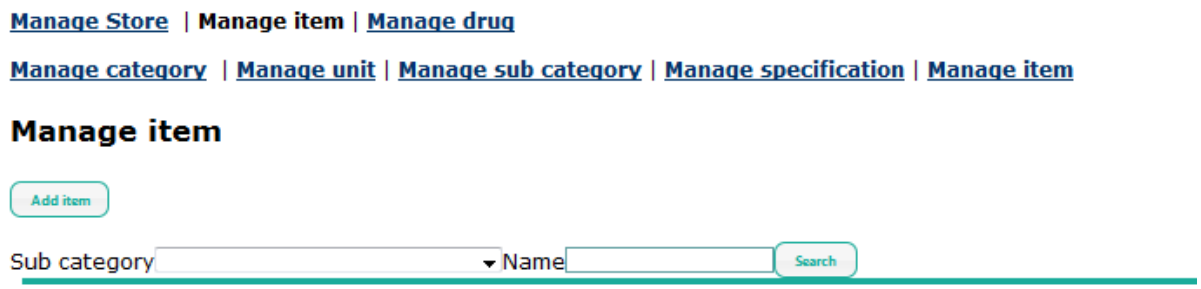


Fig 32: Manage Item sub-categories

By clicking on **Manage Item** the following list of operations appear:

- Manage categories
- Manage sub-categories
- Manage unit
- Manage specifications
- Manage item.

Manage Category

This functionality enables the Inventory Manager to create and view categories like dead stock, consumables etc. The name of the category, its description, and date of creation and created by are displayed. A search function is also available to find the desired category. Type the name of the category (or first three letters of the name of the category) on the tab and press search.

Step1: To add new category, click on the **"Manage Category"**

Step 2 : Click on **Add Category**

Step3: Type the name and description for the category

Step4: Click on **"Save"** and after saving the category will appear in category list

Manage Sub- Category

This functionality enables the user to create or View Sub-categories like Medical consumables, linen etc. which includes the name of the category, Description, created date, created by.

Step1: To add new sub-category, click on the **"Manage Sub-Category"**

Step2: Click on **"Add Sub-category"** to add new sub-category

Step3: Select the category from the drop down and then type the name of the sub-category (eg: linen falls under Consumables) after that give a code to that sub category.

Step4: Click on **"Save",** and the new sub-category will appear in the Sub-category list.

Manage Unit

This functionality enables the Inventory Manager to Create or View units like Each, Roll etc. which includes the Name of the unit, Description, Created Date, Created By with Search Functionality.

Step1: To add new unit, click on the **"Manage Unit"**

Step2: Click on **"Add Unit"** to add new unit

Step3: Type the name and description of the unit that needs to be added.

Step4: Click on **"Save"**. The unit which is added will appear in the List of Unit.

Manage Specification

This functionality enables the Inventory manager to add specifications to the item. It is not a mandatory field. Certain items come in multiple specification in terms of Colour (Red, blue, yellow, green), Size (small medium large) or Volume (2ml 5ml 10 ml).

Step1: To add new specification, click on the **"Manage specification**

Step2: Click on **"Add Specification"** to add new specification

Step3: Type the name of the specification (e.g. black) and description (colour)

Step4: Click on the **"Save"**. The specification that was added (for e.g. here Colour was added) appears in the list

Manage Item

The Functionality enables the inventory manager to add or view item in the stock. This also includes the name of the item, description, created date and created by with Search functionality**.**

Step1: To add new item, click on the **"Manage item"**

Step2: Click on **"Add Item"** to add new item

Step3: Type the details of the item i.e. name of the item (e.g.: bed sheet) , select the unit from the drop down that appears and then specification of the item ,after that sub category of the item ,and then attribute whether the item is essential or non-essential, if it is essential enter the re order quantity.

Step4: Click on **"Save",** the item appears in the list

Manage Drugs

The functionality enables the inventory manager to either add or view drugs with list of operations:

- Manage Category
- Manage Unit
- Manage Formulation
- Manage Specification

Step 1: To add new drugs, log into HIS as administrator and click on the **"Administration"** menu link.

Step 2: In the Administration Menu, click on "**Manage Drug"**

Manage Category

Step1: To add new category, click on the **"Manage Category"**

Step2: To add new category, click on **"Add Category".**

Step3: Type the name (E.g. Anti-anaemic drugs)and description for the category.

Step4: Click on **"Save"** and after saving the category will appear in category list

Manage Unit

The Functionality enables the Inventory manager to create units for drugs like pack, strip etc

Step1*:* To add new unit, click on the **"Manage unit"**

Step2: Click on **"Add Unit"** to add new unit.

Step3: Type the name (e.g. each, strip, pack)and description of the unit that needs to be added.

Step4: Click on **"Save"**. The unit which is added will appear in the List of Unit.

Manage Formulation

The Functionality enables the inventory manager to create formulations to the drugs.

Step1: To add new formulation, click on the **"Manage formulation"**

Step2: Click on **"Add Formulation"** to add new formulation, but before adding the new formulation. It's important here to check the formulation that you need to create; if it already exists you need to check the list of formulations that already exist. If the drug that you have entered has a formulation that matches with a formulation already exit this window, else create new formulation by clicking on the **"Add Formulation".**

Step3: Type the formulation (ex: Inj., Tab) then enter the dosage (ex: 1mg, 1mg/ml) then description about the formulation.

Step4: Click on the **"Save"**. The formulation that we just added appears in the list.

Step5: Delete Selected Option is used when the Inventory Manager do not want the formulation to be used in the list of the formulations .By Clicking on delete selected, the selected formulation can be deleted. The formulations which are already in use can't be deleted. After Category, unit and formulation have been created we can index (manage) a drug.

Manage Drug (Add New or View Existing Drugs)

Step1: To add new drugs or view existing drugs, click on the **"Manage Drugs"**

Step2: Click on **"Add Drug"** to add new drug, but before that ensure from the list that appears that the drug you want to create isn't there already; you can also use the search function to find the desired drug. If the name of the drug does not appear in the list press on the **"Add Drug"**

Step3: Type the name of the drug (e.g. diazepam). Each Drug has been mapped in the System. Then map the name of the Drug with its concept, and then select the desired formulation from the drop down that appears. Next, select unit from the drop down that appears then drug category. All the drugs have an attribute, vital, essential, desired, that select the requisite attribute for that drug, if the drug is essential drug enter the re-order qty.

Step4: Click on the **"Save".** The drug that we just added appears in the list.

Laboratory Module

There are **2 Laboratory Units** in the hospital namely

- **Clinical Pathology** (8:00 AM-2:30 PM)
- **Emergency Pathology (**2:30 PM onwards)

The Laboratory has the following **5 Sub-departments**:

- Biochemistry (Patient load of 150 patients/day)
- Microbiology (Patient load of 125 patients/day)
- Immunology (Patient load of 50 patients/day)
- Haematology (Patient load of 150 patients/day)
- Histopathology (Patient load of 5-10 patients/day) - This department functions as a separate lab altogether which has further subdivisions:
  - FNAC
  - Biopsy
  - Cytology

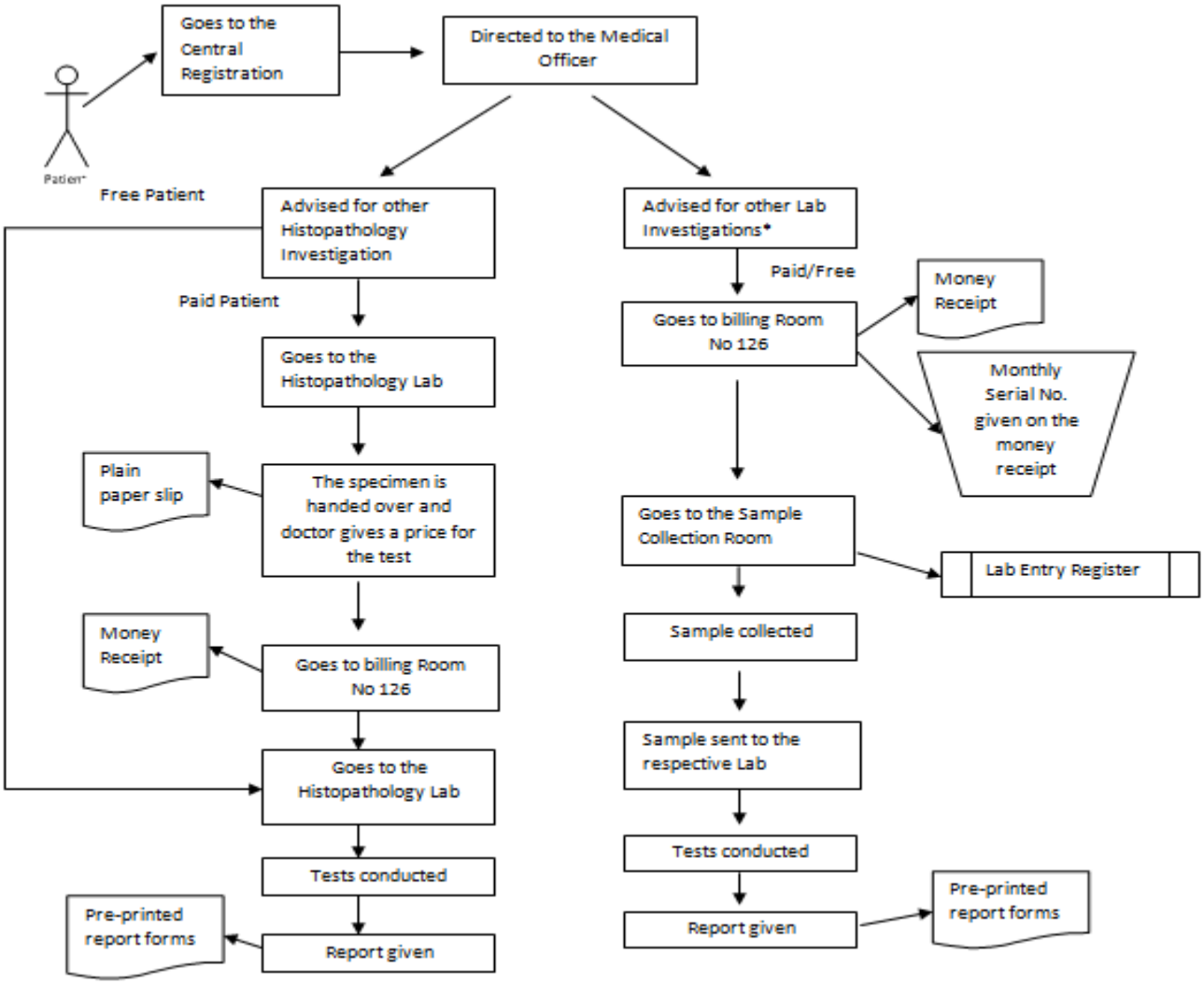


Fig 33 : Process flow for Laboratory

The Laboratory Module involves the following customizations:

Adding the Laboratory Tests in Concept Dictionary

To begin with, the laboratory tests have to be added in the Concept Dictionary; the following steps are followed to do the same:

Step 1: To add laboratory tests, log into the HIS as administrator, once you successfully log in, Click on the **"Dictionary"** menu.

Step 2: In the dictionary, click on **"Add New Concept".**

Step 3: Type the details about the Tests; Select the class and data-type i.e. Test and Numeric or Test and Text or Lab-set and Coded.

Step 4: Click on **"Save",** to save the concept.

Manage Laboratory Department

The next customization level of laboratory module includes mapping of the laboratory department list so that they appear in their modules. This functionality of Department list enables the Laboratory user to create, edit and delete Labs

The following steps have to be followed in order to map the laboratory departments so that they appear in the Laboratory module:

Step 1*:* To add Laboratory Departments, log into the HIS as **Administrator** and click on the **"Administration"** menu.

Step 2*:* In the Administration Menu, Click on **"Department List".**

Step 3: To add new department click on "**Add New Department"**.

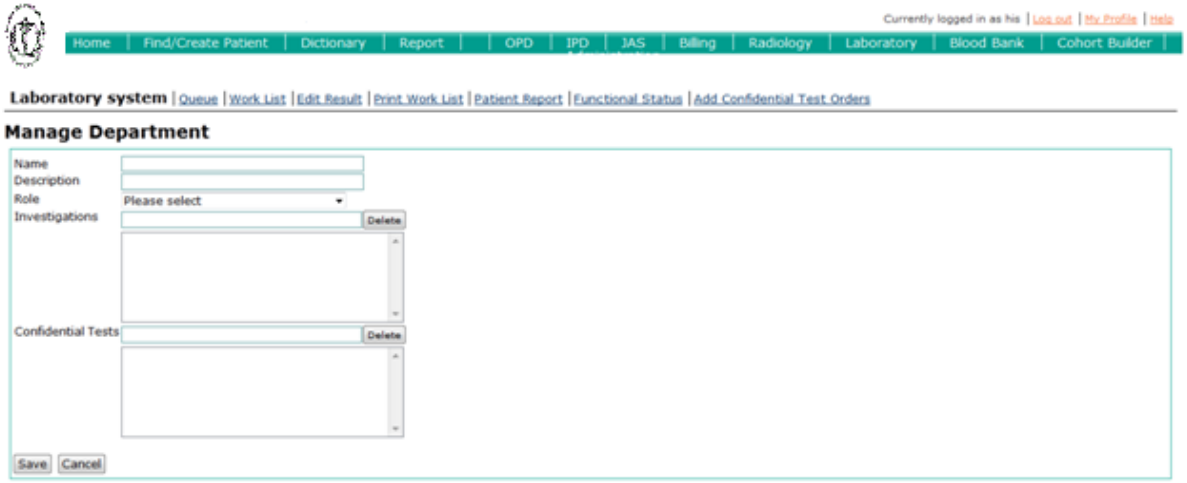


Fig 34: Add Department

Step 4: Type the name, description and role (Lab Technician created for managing lab) and add the investigations by typing the name of lab and concept window appears, and select the corresponding concept. In the same manner, confidential tests (if any) can also be added.

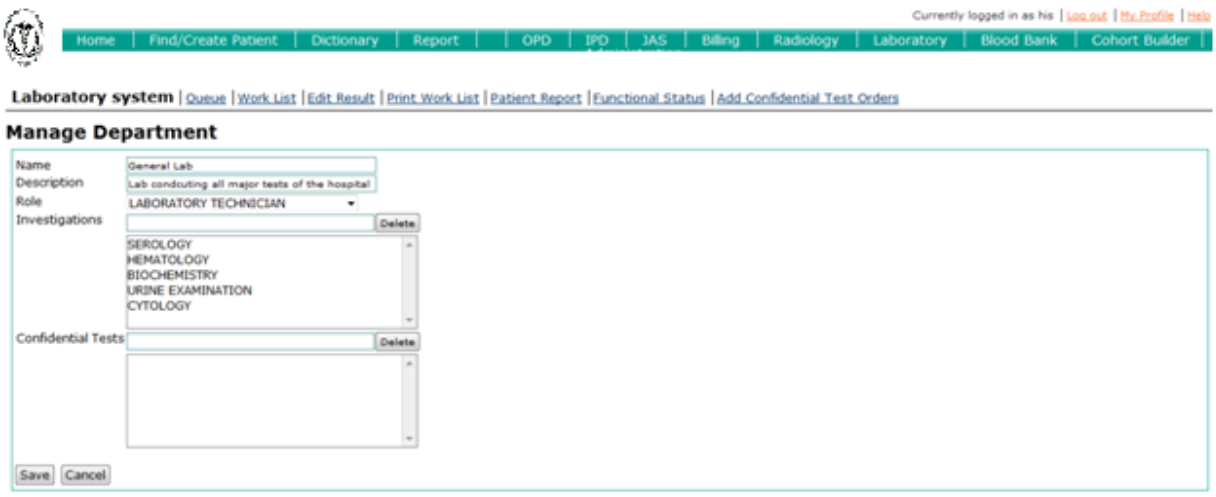


Fig 35: Laboratory Department Details

Step 5: Click on **"Save".** The department that has been created will appear on the following screen.

Functional Status

Functional status is an administrative right to deactivate a test from Laboratory, and hence its appearance in the Billing. Once a test has been deactivated, its name does not appear in the billing. The specific test cannot be billed once it has been deactivated.

To deactivate a test,

Step 1: Go to the Laboratory Module from the navigation menu and select Functional Status.

Step 2: Check the name of the test

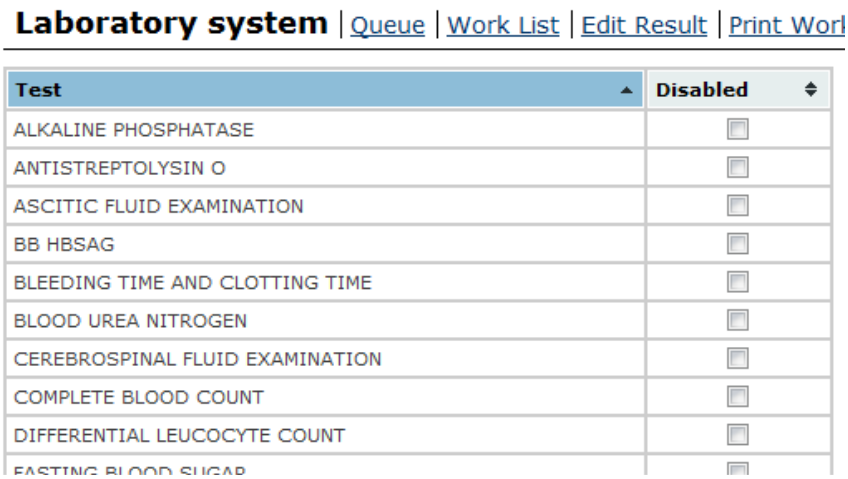


Fig 36 : Selecting tests

Step 3: Save by clicking on the ‘Save’

The disabled test will hence not appear in the billing.

Reports Module

The report module aids in generating various reports which help the hospital management to keep track of the functioning of various departments in the hospitals. The reports comprise of administrative, financial, logistics and many more. The Report Module involves the following customizations:

Adding Reports

To begin with, the reports have to be added in the manage report section of administration; the following steps are followed to do the same:

Step 1: To add reports, log into the HIS as administrator, once you successfully log in, Click on the **“Administration”** menu.

Step 2: Click on **“Manage Report”**

Step 3: Click on “**List option”** and then click on **“Add New Report”**

Step 4: Type the Name and Description.

Step 5: Click on **“Save”.** The report that has been created will appear on the following screen.

Step 6: Click on **“**R**eport type”**

Step 7: Enter type of report and click on browse and give the path of “**rpt”** design file and Click on **“Save”**

Step 8: Click on **“View reports”** to check its working or not.

Step 9: Go to **“Administration”**

Step 10: Click on **“Manage report”**

Step 11: Click on **“Assign report to role”**

Step 12: Assign the role to access the report

Testing

Testing is an important step which is to be done after the customization of the software is complete. Once the modules were developed in accordance with the hospital requirements, each of it was put on rigorous testing. The modules were run offline and checked for every possible error.

The testing of Modules is done in 2 rounds

Round1:

In this round the whole process flow of the system is tested by logging in as System administrator.

Round 2:

This is also known as Role-specific testing i.e. in this round the process flows of different modules are checked by logging in with a specific role. E.g. Laboratory Module is tested by logging in as Lab Technician and Lab Administrator. In doing so, we can also test whether the roles and privileges assigned to those roles are functioning properly or not.

Check list before testing the application

1. Change the identifier prefix for NIKDU hospital, Bangladesh.
2. Upload the xml files for address, OPDs, IPDs, districts and referrals.
3. Make sure registration slip is ready with respective investigations and logo for particular hospital
4. Make sure all person attributes are there(in administration, 'manage person attribute types')
5. In address field the default district should be related to the NIKDU hospital.
6. All OPD, IPD departments should be created with respective diagnosis and procedures(administration-hospital core)
7. Make sure in billing hierarchy the investigation prices should be equal to investigation prices in manage billable services(administration)
8. Make sure in laboratory, for all investigations, ranges and units are getting printed in patient report
9. Create laboratory role and department with sub-labs for working of lab module
10. Create radiology role and department with radiology investigations for working of radiology module
11. Make sure default form should work for all investigations before making forms
12. Make sure in the global properties the x-ray default form ID should be equal to form ID in the address (x-ray default form in manage forms, see the ID in the address field)
13. The default template should come for all investigations except Antenatal Ultrasound.
14. Make sure in template the radiologist signature should be for respective hospital
15. Create main store role and create store in inventory for working of inventory
16. Create sub store role (eg: pharmacy) and while creating sub store in inventory make sure the parent should be main store for substore.
17. Check all global properties
18. Paste BB forms, check BB concepts (Boolean to datatype /coded)
19. Create roles and users

CHAPTER 3 : RESULTS

The process of customization of DHIS Hospital for Bangladesh Hospitals was a process that involved thorough understanding of the requirements gathered and the incorporation of these requirements into the final product that had to be delivered.

Another crucial step after customization is complete is the testing. Testing of DHIS Hospital in this case was doubly important, since not only one had to make sure that the information was flowing correctly from point A to point B, but also that some nuances that were specific to Bangladesh hospitals were incorporated seamlessly into the software.

Exhaustive testing was carried out and the bugs found were filed on Redmine (the project management software that HiSP India makes use of). These bugs were assigned to respective people responsible for those particular bug corrections. Once resolved, the issues were raised once again on Redmine and testing was carried out again.

Some of the bugs that were found out were as follows :

- The software was accepting a future date for birthdate of an individual, a validation rule had to be created for the same.
- It would show ‘Rupees’ instead of ‘Taka’ for currency.
- X Ray and Blood bank forms turned up blank. A global property called ‘form id number’ had to be corrected.
- Prices of certain tests would not show up in billing. The prices had to be entered in the billing hierarchy.
- Certain roles could not perform all their tasks and access was denied to them. Privileges had to be assigned to those roles.
- Some investigations would not show in the laboratory, concepts had to be created for the same.
- Sub-labs would not show under General Laboratory. Sub-labs had to be created under administration.
- The National ID could have any length, validation rule had to be created for the same.

CHAPTER 4 : DISCUSSION

Some of the observations made during the study are as follows:

- All through the process, the developers release the modules phase wise, and they are simultaneously tested.

- Creating a checklist before testing is necessary because it highlights beforehand what needs to be checked and gives an idea about the possible errors that may arise. It also helps in checking whether all the aspects of the customization have been covered or not.

- Any steps of customization missed may lead to that module and consequently other modules not working as they should.

- The preceding step to customization is requirements gathering. Customization should be on the lines of requirements gathered from the hospital. If these requirements are not gathered properly, the chances of problems arising during the customization process increase greatly.

- During testing, the gaps in customization can be found out and the necessary changes in the baseline can be made before the system is deployed in the hospital.

-Various bugs and issues were found during the testing phases which were reported on the RedMine.

CHAPTER 5 : CONCLUSION AND RECOMMENDATIONS

- It is very important to sign off on requirements gathered to make sure that the client doesn't change their requirement so frequently that it creates problems for the successive steps.
- Testing checklist should be revised periodically.
- Empowering the clients with knowledge and thorough understanding of the product always pays.

CHAPTER 6 : Case study on Evaluation of Training for DHIS Hospital in Bangladesh

Introduction and purpose of study :

Evaluation involves the assessment of the effectiveness of training programs. This assessment is done by collecting data on whether the participants were satisfied with the deliverables of the training program, whether they learned something from the training and are able to apply those skills at their workplace. Having recently completed a round of training on DHIS Hospital in Bangladesh, the following study was conducted to evaluate the effectiveness of the training provided as well as to identify the loopholes of the same so as to improve for the future.

Benefits of Training Evaluation

Evaluation acts as a check to ensure that the training is able to fill the competency gaps within the organisation. Following are some of the benefits :

- **Evaluation ensures accountability -** Training evaluation ensures that training programs comply with the competency gaps and that the deliverables are not compromised upon.
- **Check the Cost -** Evaluation ensures that the training programs are effective in improving the work quality, employee behaviour, attitude and development of new skills within the employee within a certain budget.
- **Feedback to the Trainer / Training -** Evaluation also acts as a feedback to the trainer or the facilitator and the entire training process. Since evaluation accesses individuals at the level of their work, it gets easier to understand the loopholes of the training and the changes required in the training methodology.

Objectives :

To evaluate the effectiveness of the training given to DHIS Hospital users at NIKDU Hospital, Bangladesh.

Methodology :

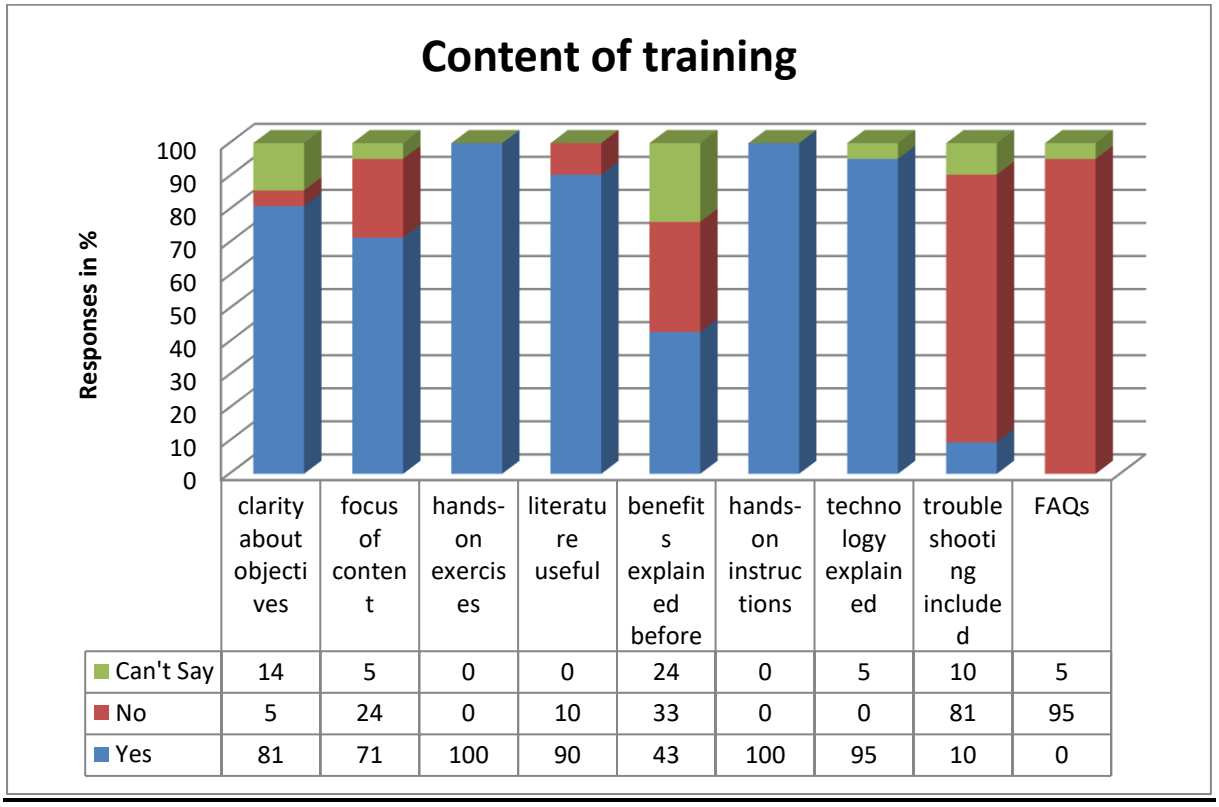
Study design : Cross sectional, descriptive

Study area : NIKDU Hospital, Bangladesh.

Sampling and sampling design : This is a quantitative study which originally included 25 respondents who were chosen by random sampling., out of which only 21 responded.

Data collection tool : Questionnaire which consisted mostly of close-ended questions with responses on a likert scale, and others on a scale of 1 to 10 and yes-no-can't say. Information thus obtained was analysed.

Observations :



	clarity about objectives	focus of content	hands-on exercises	literature useful	benefits explained before	hands-on instructions	technology explained	troubleshooting included	FAQs
Can't Say	14	5	0	0	24	0	5	10	5
No	5	24	0	10	33	0	0	81	95
Yes	81	71	100	90	43	100	95	10	0

Fig 37 : Content of training

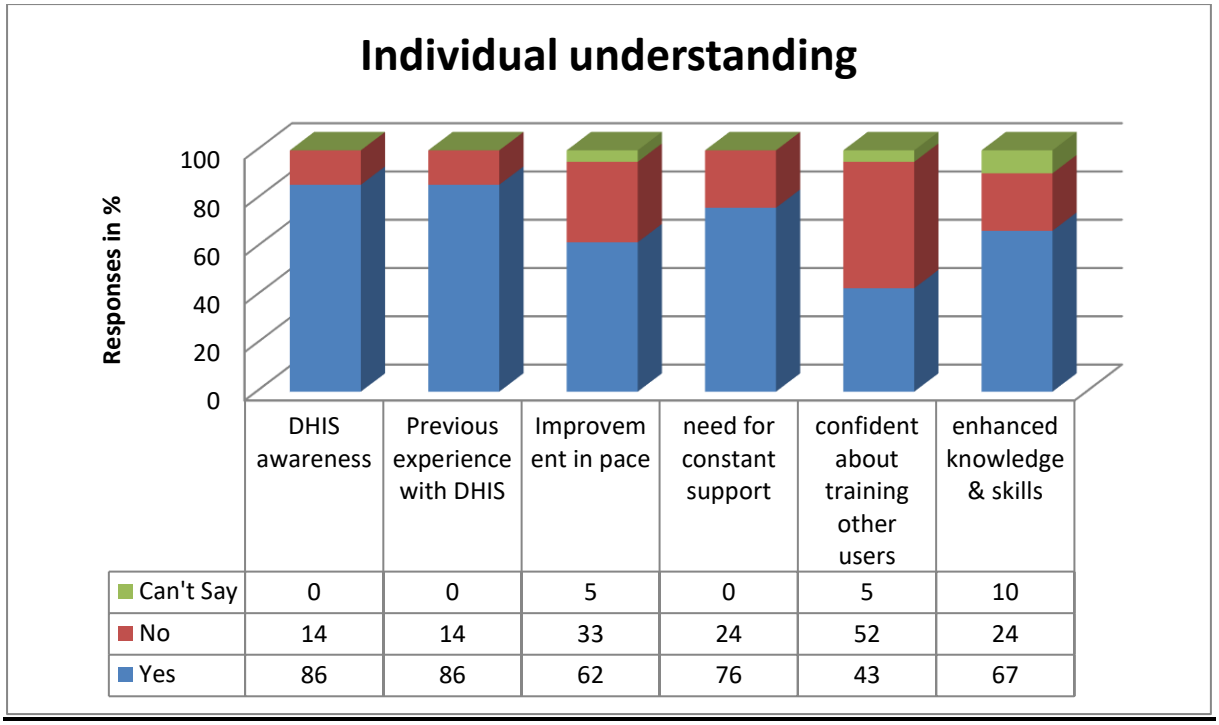


Fig 38 : Individual understanding of trainees

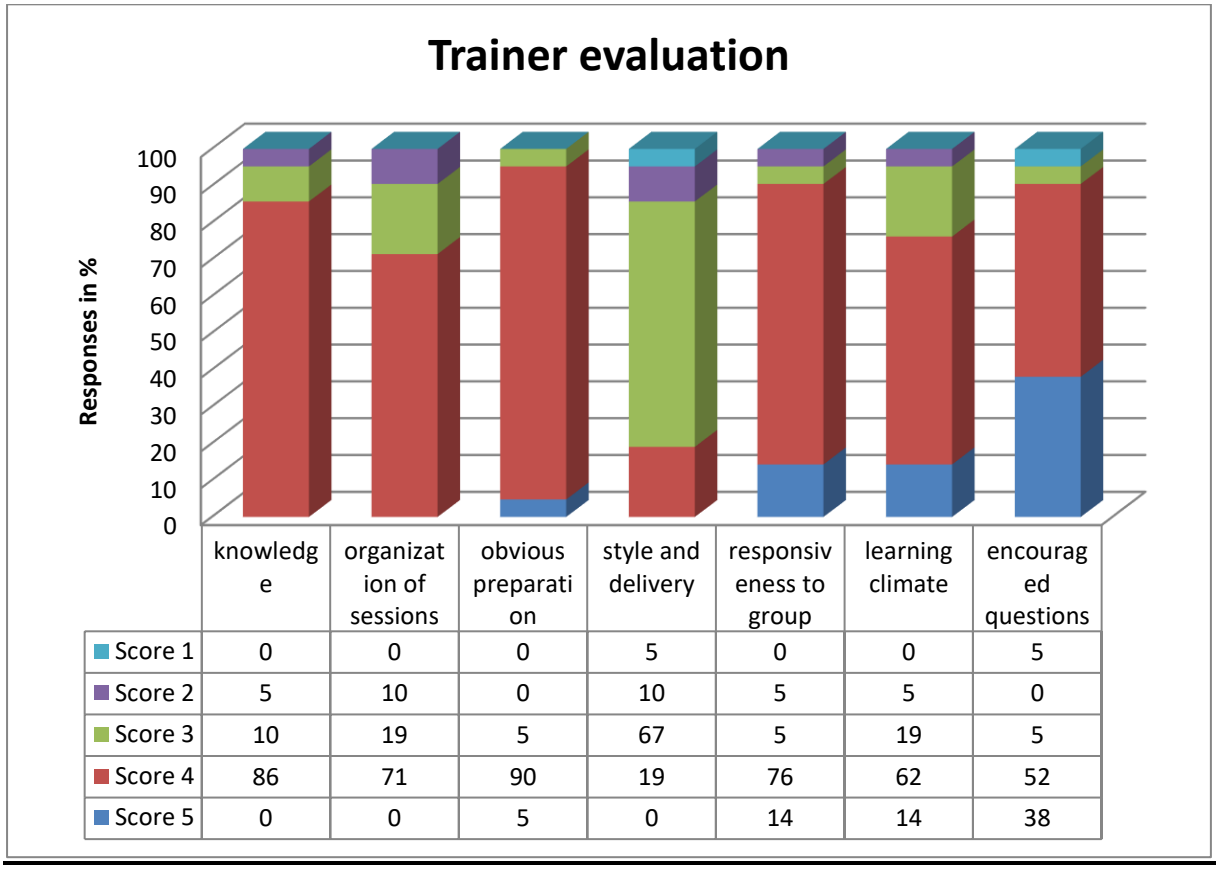


Fig 39 : Trainer evaluation

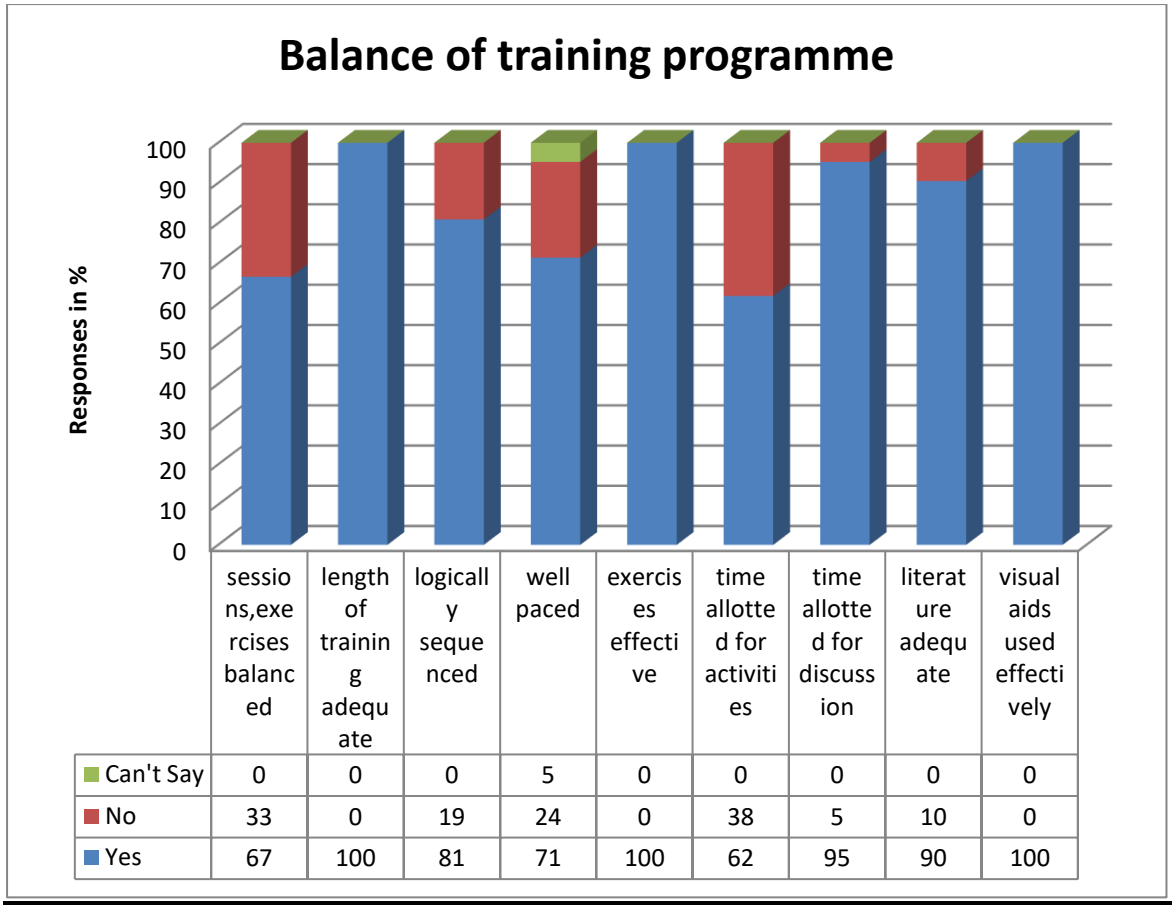


Fig 40 : Balance of training programme

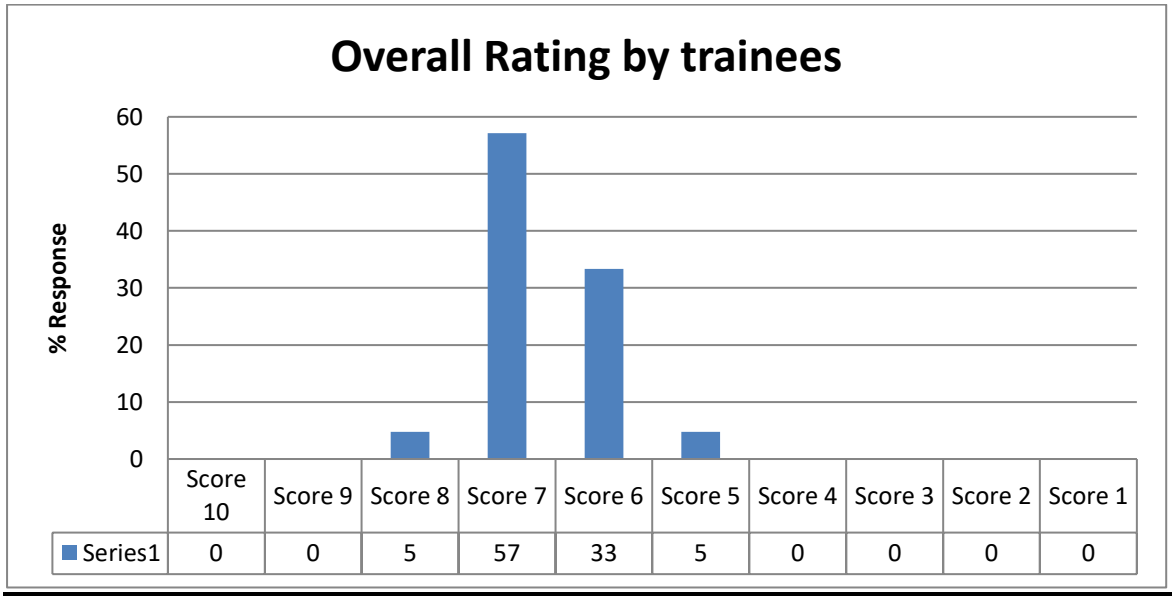


Fig 41 : Overall rating of training by trainees

Conclusion :

While the responses were swaying more in the favour of the training conducted, there were certain areas that could use some work, for instance the level of confidence among trainees regarding their being able to train other users now seems lower than one would have liked to see.

Limitations of study :

1. Small sample size.
2. No authentication of the respondents could be done as the questionnaire was sent via email.

Recommendations :

1. Follow up should be carried out with the trainees about their feedback to probe deeper into their responses through focus-group discussions or interviews.

References

1. Tiwari R, Tsapepas DS, Powell JT, Martin ST Enhancements in healthcare information technology systems: customizing vendor-supplied clinical decision support for a high-risk patient population 2013 Mar-Apr;20(2):377-80https://www.ncbi.nlm.nih.gov/pubmed/22813760

2. Coyle-Toerner P, Collins L. How the clinical customization of an EMR means good business: a case study of Queen City Physicians. 2003 Jul-Aug;19(1):27-31.https://www.ncbi.nlm.nih.gov/pubmed/12971002

3. Marilyn A. Rath and Julie C. Ferguson Hospital Based Customization of a Medical Information System1983 October 26: : 72–75 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2578453/

4. Takian A, Sheikh A, Barber N. We are bitter, but we are better off: case study of the implementation of an electronic health record system into a mental health hospital in England. 2012 Dec 31;12:484. http://www.ncbi.nlm.nih.gov/pubmed/23272770

5. Coyle-Toerner P, Collins L How the clinical customization of an EMR means good business: a case study of Queen City Physicians. 2003 Jul-Aug;19(1):27-31.https://www.ncbi.nlm.nih.gov/pubmed/12971002

6. Tiwari R, Tsapepas DS, Powell JT, Martin ST. Enhancements in healthcare information technology systems: customizing vendor-supplied clinical decision support for a high-risk patient population. 2013 Mar-Apr;20(2):377-80.https://www.ncbi.nlm.nih.gov/pubmed/22813760

7. George M Alliger, Elizabeth A Janak Kirkpatrick's levels of training criteria : Thirty years later 7 Dec 2006 DOI : 10.1111/j.1744-6570.1989.tb00661.x http://onlinelibrary.wiley.com/doi/10.1111/j.1744-6570.1989.tb00661.x/abstract

8. Sales training evaluation, an evaluation of effectiveness of sales training presentations, skills, analysis tools and strategies. http://www.questionpro.com/a/showSurveyLibrary.do?surveyID=128&mode=1

APPENDIX 1

Name of respondent : _____

Age group : (a)18-25years (b)26-35years (c)36-45years (d)46years & above

Gender : _____

Designation : _____

Work Experience : _____

Days of training attended : _____

Training attended (a)After office hours (b)During office hours

Following is a questionnaire based on the DHIS Hospital training that you underwent. Please choose the most appropriate answer according to you.

1. 0 Content of training :

1.1 Were you clear about the objectives of the training?

-Yes -No -Can't Say

1.2 Was the content focused on the objectives of the training?

-Yes -No -Can't Say

1.3 Were hands-on exercises a part of the training?

-Yes -No -Can't Say

1.4 Was the literature provided before and during the training useful ?

-Yes -No -Can't Say

1.5 Were the benefits of DHIS Hospital and the purpose of training explained to you beforehand?

-Yes -No -Can't Say

1.6 Were hands-on instructions included in the manual ?

-Yes -No -Can't Say

1.7 Was the technology behind DHIS Hospital explained to you during training?

-Yes -No -Can't Say

1.8 Did the training include troubleshooting in case errors arise?

-Yes -No -Can't Say

1.9 Did the manual shared with you contain FAQs ?

-Yes -No -Can't Say

2.0 Individual understanding :

2.1 Were you aware of DHIS before the training?

-Yes -No -Can't Say

2.2 Have you worked on DHIS before?

-Yes -No -Can't Say

2.3 If your answer to Q 2.2 is yes, do you think the training has helped improve the pace at which you work on DHIS?

-Yes -No -Can't Say

2.4 Will you still need constant support from HISP when you start working on DHIS Hospital?

-Yes -No -Can't Say

2.5 Do you feel confident enough to train other users now?

-Yes -No -Can't Say

2.6 Do you think the training has enhanced your knowledge / skills?

-Yes -No -Can't Say

2.7 What will you use DHIS Hospital for?

a) Reporting

b) Analysis

c) Patient Management

d) Others (please specify)

3.0 Trainer Evaluation:

Please rate the trainers based on the following parameters :

(a) Knowledge of subject

5 4 3 2 1

(b) Organization of sessions

5 4 3 2 1

(c) Obvious preparation

5 4 3 2 1

(d) Style and delivery

5 4 3 2 1

(e) Responsiveness to group

5 4 3 2 1

(f) Producing a good learning climate

5 4 3 2 1

(g) encouraged participation and questions

5 4 3 2 1

4.0 Balance of training programme :

4.1 Do you think the sessions, exercises and discussions were well-balanced?

-Yes -No -Can't Say

4.2 Do you feel the length of the training was adequate?

-Yes -No -Can't Say

4.3 Do you think the programme was logically sequenced?

-Yes -No -Can't Say

4.4 Do you feel the programme was well-paced?

-Yes -No -Can't Say

4.5 Do you think the exercises were effective?

-Yes -No -Can't Say

4.6 Was the level of time allotted for (a) the activities and (b) the follow-up discussion sufficient?

a) -Yes -No -Can't Say

b) -Yes -No -Can't Say

4.7 Was the literature issued adequate for understanding?

-Yes -No -Can't Say

4.8 Were the visual aids (Powerpoint slides) used effectively?

-Yes -No -Can't Say

5.0 Overall rating of training:

5.1 Please rate the overall value of the course to you on a scale of 1- 10.

1 2 3 4 5 6 7 8 9 10

5.2 Do you think you will still need a refresher training programme on DHIS Hospital?

Strongly Agree – Agree – Neutral – Disagree - Strongly Disagree

5.3 If yes, which modules in particular would you need more training in?

5.4 Do you think training objectives were met?

Strongly Agree – Agree – Neutral – Disagree - Strongly Disagree

5.5 Could you list out certain specifics about DHIS Hospital that you are NOT thorough with, or need more training in.

_____

5.6 Are there any aspects of the training that you think could have been handled differently? (Please specify which ones.)

_____