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ORIGINAL ARTICLE

A Study on the Utilization of Hospital Information System (Ward and Physician) Modules in a Tertiary Care Hospital

[1]AP Pandit, [2]Tanima Debmallik, [3]Meenal Kulkarni

ABSTRACT

Introduction: Hospital information system (HIS) is a key managerial tool for any hospital administrator. It gives him all requisite information online, wherever he is and whatever he is doing, so that he can apply timely interventions and set the things right and thereby take care of patient safety, quality improvement, and also minimize litigation problems in the hospitals.

After the initial introduction of HIS into the organization, the key findings were that the entire hospital operations are HIS driven. From the registration and admission of the patient, to the discharge summary generation of an inpatient, the entire process is guided by the HIS. It was found that the HIS is billing-centric, i.e., the HIS use pathway begins only when the registration fee is billed and the unique health identification number (UHID) of a patient is generated.

The main HIS modules under study are the Ward module and the Physician module. After conducting a utilization study using a structured questionnaire, it is found that the level of utilization of the Ward module is 36.4% and that of the Physician module is 6.66%. Using a Fishbone analysis, the causes of reduced HIS utilization have been identified and using a Pareto analysis the main causes have been found to be Work culture and Lack of mobile handheld devices. Various recommendations have been made to increase the HIS usage.

Keywords: Health care workers, Hospital information system, Physician module, Ward module.

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AIM

A study on the utilization of hospital information system (HIS) (Ward and Physician) modules in a tertiary care hospital.

[1]Professor, [2]Student, [3]Assistant Professor

[1-3]Symbiosis Institute of Health Sciences, Pune, Maharashtra India

Corresponding Author: AP Pandit, Professor, Symbiosis Institute of Health Sciences, Pune, Maharashtra, India, Phone: +919423212709, e-mail: apandit70@hotmail.com

OBJECTIVES

- To study the utilization pattern of HIS modules (Ward and Physician modules) in a tertiary care hospital.
- To recommend the remedial measures, if there is gross underutilization of HIS modules.

REVIEW OF LITERATURE

An HIS is a computer system that is designed to manage the hospital's medical and administrative information in order to enable the health professionals to perform their jobs effectively and efficiently. Hospital information systems have a great potential to reduce time, health care costs, and improve outcomes. The information system is capable of capturing, storing, processing, and communicating timely information to the various end users that help to identify the risk of potential adverse events.[1] Generally, the main goals of the HIS are to improve the efficiency of the staff, to remove duplication and unnecessary procedures, to computers as work tools, aiding in performance analysis by making statistics and data mining techniques faster and more accurate, to improve the quality of health care, to create a modern working methods and systems and standardized hospital data communication systems and medical engineering, and to increase data communication between hospitals and medical centers. There is an urgent need to review how the HIS fits into the organizational structure of the hospital and the operational role played by the physicians in it.[2] It is observed that the HIS provides tremendous opportunities not only to reduce errors but also to support the health care professional's job by making available timely up-to-date information, to increase the efficiency of patient care by reducing patient waiting time and to improve the quality of care.[3] According to the BMC Health Services Research 2013 edition, the data stored in the HIS due to proper HIS use is also essential for health care performance indication (PI) studies, which need it for continuous improvement.[4] All in all, it is essential for improved patient care quality.[5]

MATERIALS AND METHODS

A structured questionnaire with one open-ended question was prepared for the Ward module and the Physician module respectively. The study variables were computed

as a comparison in terms of percentage between the available sections, the usable sections, and the actually used sections. A convenient sample size of 30 nurses from 5 wards and 5 outpatient department (OPD) doctors was taken under consideration in the study. Six respondent nurses were randomly chosen from each ward, 2 from each nursing station including 1 medical officer (MO) from each ward. Nurses were the target respondents because in wards they are the end users of the HIS.

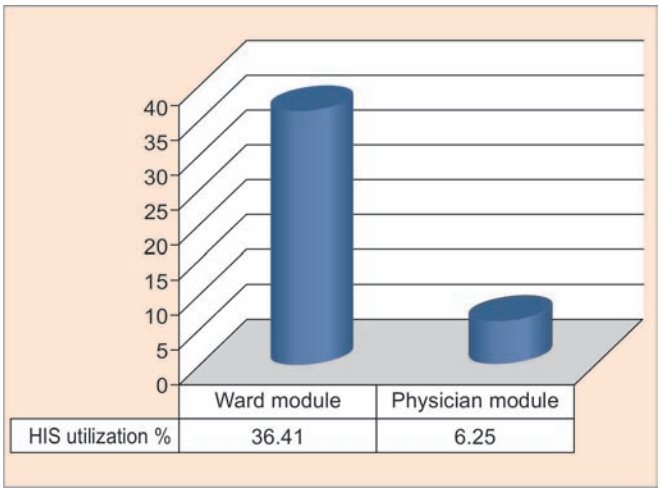
An introduction about the project and the main aim of the study was given to the respondents and it was told to them that their response is vital. The structured questionnaire was administered to the nurses at the end of their daily orientation program. For the OPD doctors, the questionnaire was taken to them personally.

OBSERVATIONS AND DISCUSSION

- Total number of sections in the ward module = 62
  Average number of sections used = 22.58
  Overall percentage utilization = 36.41%
- Total number of written documents maintained in the wards = 33
  Number of these documents that have provisions in the Ward module of the HIS = 19
  Percentage of documents that can be maintained in the HIS but are maintained in hard copy = 57.57%
- Total number of sections in the Physician module = 16
  Average number of sections used = 1
  Overall percentage utilization = 6.25%

The level of utilization of the major HIS modules in the hospital was found to be very low shown in (Graph 1). The causes for this low level of utilization were found.

The overall operational pathway of HIS usage was mapped and then the deviations from the pathway were found.



Graph 1: Utilization of the hospital information system

The overall process (Flow Chart 1) has been explained as follows:

- The patient enters the hospital and registers himself by paying 150 rupees at the registration desk. The REGISTRATION MODULE is used to enter patient name, age, sex, primary consultant's name, and the patients unique health identification numbe (UHID) is automatically generated by the Registration module. This is a unique one-time patient's number that can be rechecked to see if previously he had been admitted or not.
- An OPD patient then takes the receipt and goes to the OPD department for consultation.
- The patient details are reflected in the PHYSICIAN MODULE.
- The consultant physician sees the patient, prescribes him medicines, investigations.
- Taking this prescription, the patient goes to the OPD pharmacy and procures the medicines.
- Based on this prescription, the patient goes to the admission department to enquire about and pay for the investigations needed – Laboratory-based Radiology or Cardiology.
- On receiving receipt, the patient goes to the respective investigation department and test is done.
- The tests results are collected from the enquiry.
- Based on the test result/advise of the consultant, the patient leaves/gets admitted.

Inpatient Department Process

- The UHID and details of the new admitted patient gets updated in the WARD MODULE.
- The bed occupancy status gets updated in the WARD and HOUSEKEEPING MODULES.
- Sister incharge creates patient file hard copy – provision is there in HIS but not used.
- Nurse fills assessment sheet and nursing notes in hard copy.
- MO takes patient medical history.
- Consultant doctor visits and gives Investigation/ Medication advice in treatment sheet.
- Nurse copies these manually in the patient file and indents in the respective HIS modules.
- The results of investigations are printed and again values are manually copied in the patient file by nurse.
- Consultant doctor sees them while on rounds.
- Dietician on rounds sees patient details from the file and advices diet which the nurse copies in the file and accordingly diet is served.
- Operation theatre (OT) request and scheduling is done using OT MODULE.
- Drugs in excess are indented in DRUGS RETURN part of WARD MODULE by nurse.
- For discharge, the discharge summary letterhead is printed and given to Consultant.

- Consultant writes and gives to scribe for typing.
- This copy is corrected by physician and again given to scribe for typing.
- This version is handed to the patient party.
- After patient physically leaves the bed, bed status is changed and housekeeping takes over for preparing the bed for next patient using WARD and HOUSEKEEPING MODULES.

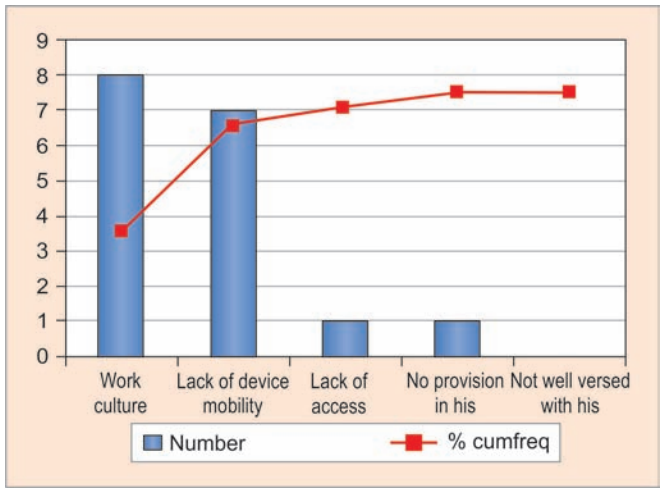
PARETO ANALYSIS ON ERRORS AND CAUSES OF ERRORS

Based on the above data collection, the following Pareto analysis (Table 1 and Graph 2) was done:

Table 1: Work Culture Device Mobility Access of HIS

Causes	*Number*	*Cum.Freq*	*%Cum.Freq*
Work culture	8	8	47.05
Lack of devise mobility	7	15	88.23
Lack of access	1	16	94.11
No provision in HIS	1	17	100
Not well versed with HIS	0	17	100

The Pareto analysis (Graph 2) is done to analyze from which cause, the maximum errors arise. The parameters under study are number of errors and the causes of errors.



Graph 2: Pareto analysis: Ward module usage

From the above Pareto chart, it is observed that the major contributors of error are Work culture in the hospital and Lack of devise mobility or Lack of handheld devices.

A gap analysis is done (Table 2) indicating the differences in how the HIS must be used and how it is being used. Also, the responsible personnel and respective HIS modules have been stated in the following Table 3:

Flow Chart 1: The flow of patients' activities from registration to the OPD consultant physician through the HIS and what the physician should use the physician module to do further.

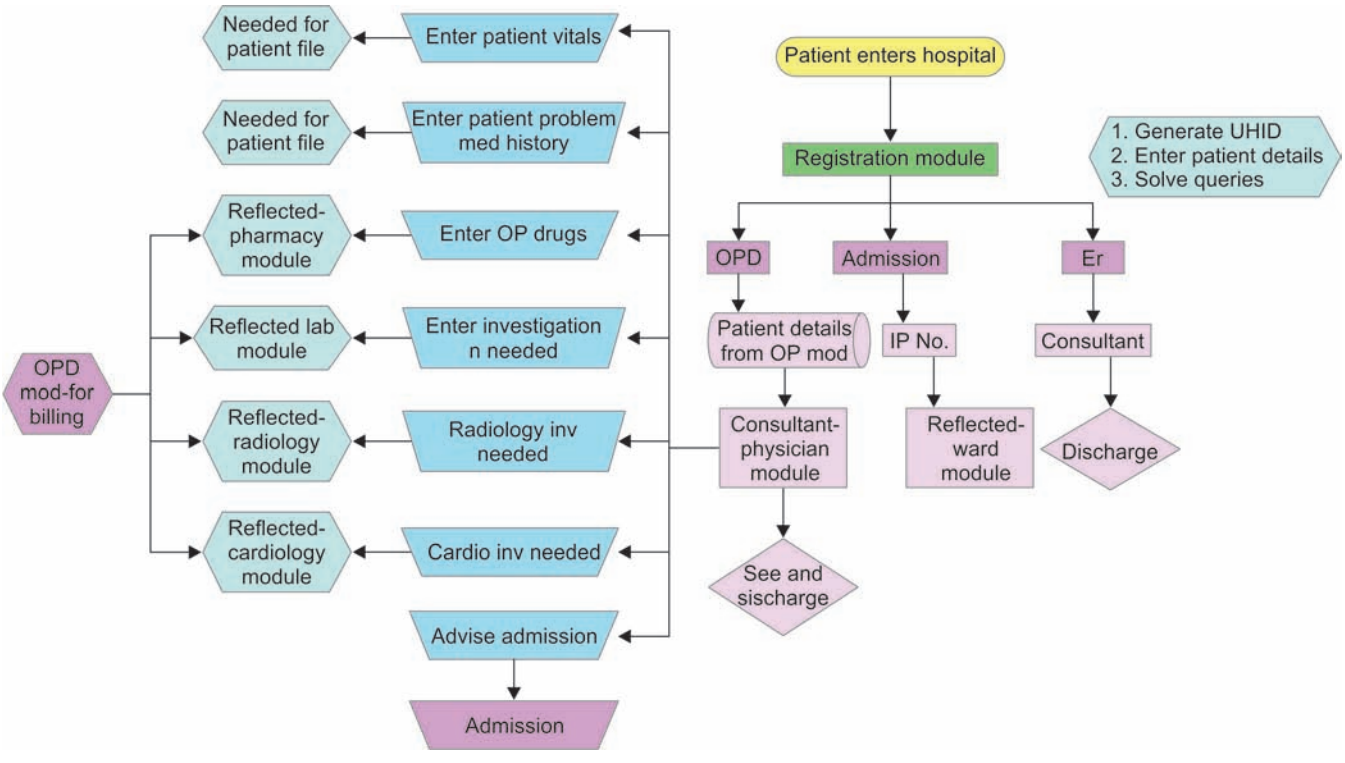


Table 2: Differences in how the HIS must be used and how it is being used

Sl No.	*Error pathway*	*What it should be*
1	Consultant doctor in OPD gives written orders to patient about admission, drugs, and investigation	Consultant doctor in OPD must input the UHID of the patient, give the consultation in a digital prescription using the Physician module.
2	Consultant does not enter history and other patient details in module	Consultant doctor enters patient details in the patient vitals, details, and patient file section of the physician module. This patient file gets reflected in the Ward module also and in turn reduces the clerical work of the nurses if the patient gets admitted.
3	Results of investigations not linked to physician module. Hard copies printed and viewed.	PACS is not linked to the HIS. But from the Laboratory and Cardiology modules, the UHID of the patient is entered and then the corresponding test results are entered. This gets reflected in the Ward and the Physician module. No printing of reports required.
4	Admission advise given in writing not through HIS	Admission advice given by the physician in the Physician module.
5	Inpatient department (IPD) – sister incharge creates patient file hard copy – provision is there in HIS but not used	If the patient is coming from the OPD – as stated earlier. Otherwise the sister incharge compiles the details directly in the patient file section of the Ward module.
6	IPD – nurse fills assessment sheet and nursing notes in hard copy	Nurse fills patient assessment sheet and nurses progress notes in the respective sections in the Ward module.
7	IPD-MO – takes medical history, checks other specifications in hard copy	MO refers to the medical history that is already entered by the physician. Or the MO enters it in the patient file section of the Ward module.
8	Consultant doctor visits and writes medications, investigations in doctors' notes. Nurse indents into HIS.	Doctor directly indents in the Ward module of the HIS.
9	Dietician visits and checks history and suggests diet to nurse, not directly through HIS Dietician module	Dietician uses the Dietician module of the HIS where on input of the UHID of the patient all details are visible and he/she can suggest diet which will be reflected in the diet chart/diet plan section of the Ward module.
10	Investigation reports from lab (SRL reports) downloaded and radiology reports printed to be viewed by consultants. No link with Physician module	This is a technical subject for the IT vendor. But direct results communication must be made available to the physician/doctor.
11	Values from hard copy report manually entered in patient file by nurse.	Test result report values are entered by the lab report compiling personnel directly in the HIS by entering the patient UHID from the Lab module of the HIS.
12	Investigation sheet, clinical chart, intake output record, diabetes management, nurses daily assessment, activity sheet, nurses progress notes, print of lab reports maintained in hard copy by writing even though provision is there in HIS	These are entered in the respective sections available in the Ward module of the HIS.
13	Discharge summary (DS) PDF printed sent to consultant who writes and then it is sent to scribe for typing, resent to consultant for checking, and final DS again typed and given.	Physician directly gives the discharge intimation and DS sections against the UHID of the patient from his Physician module from his desk or from the Ward module from the ward.

CAUSES INDEX

Cause Notation	*Cause Details*
A	No provision in HIS
B	No mobility of device – HIS only on desk top
C	Not ready to shift to new technology (work culture)
D	Not well versed with HIS
E	Lack of access

Table 3: Error details chart from observation

Sl No.	*Error*	*HIS Module*	*Cause*	*Responsibility*
1	Consultant doctor in OPD gives written orders to patient about admission, drugs, investigation	Physician	C	Consultant doctor
2	Consultant does not enter history and other patient details in module	Physician	C	Consultant doctor
3	Results of investigations not linked to physician module. Hard copies printed and viewed	Physician, Radiology, Cardiology, Lab	A,B	Lab personnel, doctor
4	Admission advise given in writing not through HIS	Physician	C	Consultant physician
5	IPD – Sister incharge creates patient file hard copy – provision is there in HIS but not used	Ward	B	Sister incharge
6	IPD – nurse fills assessment sheet and nursing notes in hard copy	Ward	B	Nurse

Sl No.	*Error*	*HIS Module*	*Cause*	*Responsibility*
7	IPD-MO – takes medical history, checks other specifications in hard copy	Ward	B	MO
8	Consultant doctor visits and writes medications, investigations in doctors' notes. Nurse indents into HIS	Ward, Physician	B	Consultant doctor, Lab/Radiology/ Cardiology personnel, Nurse
9	Dietician visits and checks history and suggests diet to nurse, not directly through HIS Dietician module	Ward, Dietician	C,B	Dietician
10	Investigation reports from lab (SRL reports) downloaded and Radiology reports printed to be viewed by consultants. No link with Physician module	Physician, Radiology, Cardiology, Lab, Ward	C,B	Lab/Radiology/ Cardiology personnel, Nurse
11	Values from hard copy report manually entered in patient file by nurse	Ward	C	Nurse
12	Investigation sheet, clinical chart, intake output record, diabetes management, nurses daily assessment, activity sheet, nurses progress notes, print of lab reports – maintained in hard copy by writing even though provision is there in HIS	Ward	C	Nurse, Sister incharge, MO
13	Discharge summary PDF printed, sent to consultant who writes, and then it is sent to scribe for typing – resent to consultant for checking and final DS again typed and given	Physician	E,C,B	Consultant doctor

FISHBONE DIAGRAM FOR CAUSE AND EFFECT ANALYSIS

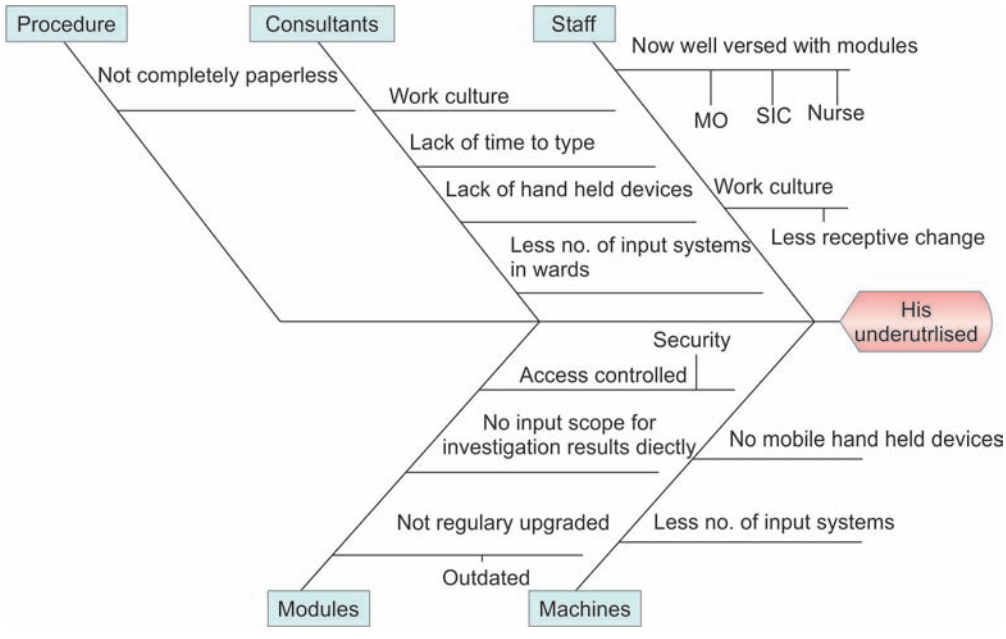


Fig. 1: Fishbone analysis

RECOMMENDATIONS

Based on the analysis and the discussion, the suggested solution to increase the HIS uses are:

- *Implementation of mobile handheld devices*: These can be in the form of electronic tabs given to the doctors in the OPD for digital prescriptions and to the MOs in the wards for input of patient data directly into the HIS. The HIS modules must be installed into the tab.
- *Implementation of a redefined policy or a new SOP* for operations in the wards that use the HIS more.
- *Expanding the current use of HIS*: As in using more sections of the modules so that the level of utilization increases.
- *Training* of the end users regarding the proper use of HIS.

The strength of the project lies in the fact that it has been based on opinions and evaluations of the real end users of the HIS and not of the policymakers in the hospital completely. All surveys are done in the natural working environment of the end users. Assumptions about data have not been made; all findings have been stated only after studying the related reports. (For example, only after

studying the FOS Report May 2015, the pilot study has been initiated.)

CONCLUSION

A well-connected and utilized HIS increases connectivity, maintains proper channels of communication and archives data about each and every step in the entire process flow from patient entry till the discharge of the patient. In this particular hospital, it was found that there was a HIS system but the main modules of the HIS were underutilized. The Ward and Physician modules of the HIS are said to be the main ones as they have the maximum number of interconnections and can be used to operate any other module. One of the major causes of underutilization is the work culture in the hospital. The workforce has been using paper and pen operations since the inception of the hospital and they are not open to the idea of a completely paperless hospital. With training and establishment of new SOPs that define a new paperless method of doing the same work, this hurdle of a stringent work culture can be overcome with the active participation of the higher management. However, greater mobility and connectivity can be achieved if the HIS is installed in handheld devices that can be carried by the end users. Many times paper forms have to be filled by the end users like staff nurses and MOs and then the same data has to be again entered into the HIS. Hence, this is a repetitive time-consuming stage in operations. If a handheld device like an electronic tab is provided with the HIS installed, then this issue can be addressed. Overall, the participation of the higher management and the dedication of the end users is what may bring about a positive change and increase the utilization of HIS modules ultimately aiming toward paperless operations in the hospital.

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Annexure "I"

Questionnaire on Physician Module of HIS Usage

DEMOGRAPHIC DATA:	DEPARTMENT:
NAME:	DESIGNATION:
AGE:	DURATION OF JOB:
SEX:	
ORGANIZATION:	

Respected doctor,

Kindly tick only those sections of the Physicians module of the HIS that are being used by you.

Manage appointments	
Patient details viewing	
Patient drug allergies	
Patient food allergies	
Patient other allergies	
Important patient-specific information entry	
The Rx-consultation outcome of the patient	
Drugs (Medicines) entry into Rx	
Investigation required	
Lab tests required	
Cardiology tests required	
Radiology tests required	
View investigation results in HIS	
Give discharge intimation	
Give discharge summary	
Patient medical history	

Thank you for your cooperation.

Your responses shall be kept confidential and used for educational purposes only.

Annexure "2"

Questionnarire on Ward HIS Module Utilization

DEMOGRAPHIC DETAILS OF RESPONDENT	
NAME:	DESIGNATION:
AGE:	DEPARTMENT:
SEX:	FLOOR:
WORK EXPERIENCE TILL DATE:	SIGNATURE:

Kindly TICK the parts of the WARD HIS MODULE that are being used in the ward. DO NOT TICK those parts which are being maintained in written and not in the HIS.

Drug allergies	
Food allergies	
Other allergies	
Investigations	
Drug orders	
Drug returns	
Medical equipment	
Case sheet	
Bedside procedures	
Intake output	
Vitals	
Other procedures	
Patient progress notes	
Nurses progress notes	
Test requisition	
Results view	
Graphical test result	
Blood request	
Transfusion feedback	
Reason for admission	
Vitals chart	
Diabetic chart	
I.V. fluid chart	
Drug administration	
Hand over/take over	
RMO progress notes	
Visiting doctors charges	
Referral doctors charges	
Transfer request	
Discharge intimation	
Discharge summary	

Patient folder	
Bed status	
Patient tracking	
Billable tariff	
Find patient	
Diet order	
Food order	
Diet chart request	
CSSD	
Physiotherapy request	
Operation notes	
Surgery activity timings	
OT schedule request	
Cath notes	
Cath patient timings	
Cath schedule request	
Biomedical	
HR	
Housekeeping	
Indent order	
Indent receipt	
Indent returns	
IP issues	
IP issues without stock	
Store consumption reports	
Admission reports	
Doctor wise/bed wise admissions	
Current inpatient reports	
Tentative discharge report	
VIP inpatients reports	
Bed status report	

Kindly TICK the most appropriate answer:

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The HIS helps me in making decisions					
The HIS has provisions to compile reports of investigations					
The HIS is easy to use					
The HIS makes my work easier					
The HIS aids in interdepartmental communication					
The HIS makes work faster, saves time					
The HIS needs some changes					

If the HIS NEEDS CHANGES to be made to it, what are the changes you think must be made?

Do you think that there should be an increased use of the HIS?

YES/NO (Please tick)

Thank you for your cooperation. Your responses shall be kept confidential and used for educational purpose only.

Annexure "3"

Questionnaire for Data Source

No.	*Date*	*Name*	*UHID*	*Case*	*Origin*	*Ease of billing rating*	*Respon-siveness of staff rating*	*Sitting arrangement rating*	*Toilets rating*	*Drinking water rating*	*Pre test Prep rating*	*Report generation time rating*	*Radiologist rating*		*Pre test delay in min*	*Post test delay in min*	*Average Delay in minutes*
1	23/6	Mir Mohd Firoze		MRI OP	OPD	5	4	5	4	5	2	1	5		120	190	Pretest av.: 41.9
2	23/6	Sarika Majeed		CTOP	OPD	4	4	4	4	4	3	1	5	Have been waiting for more than 2 hrs of the reports	37	<24 hrs	Posttest av.: 96.52
3	24/6	Ansura Bibi		CTOP	OUT	5	5	5	5	5	3	3	5	Not proper time estimation was given to them	10	<24 hrs	
4	24/6	Sonam Tobgay		CTOP	INT OP	5	5	5	5	5	5	1	5	Report not given on same day, an international patient from Myanmar could not collect his report on the same day of test. It had to be later dispatched.	37	60	
5	24/6	Mithu Ghosh		CTOP	OPD	4	4	4	4	5	2	2	4		130	<24 hrs	
6	24/6	Bandana Bannerjee		CTOP	OPD	3	3	3	4	5	2	1	5	Swiftness lacking	30	<2 4 hrs	
7	24/6	Amiyo Netai Das		CTOP	OPD	5	5	5	5	5	3	2	5		10	37	
8	25/6	Ajoy Misra		CTOP		4	4	4	5	5	2	1	5		51	<24 hrs	
9	25/6	Niloy Ghosh		CTOP		4	5	3	5	5	3	2	5		88	28	
10	25/6	Lopsang Lama		CTOP		5	5	5	5	5	1	1	4		139	10	