Medical Education Department

3.10   Arogya Online in Sawai Man Singh Hospital, Jaipur

3.10.1   Introduction

Hospital Management Information System (HMIS) known as 'Arogya Online' was an initiative of Government of Rajasthan to deliver better quality of healthcare to citizens of the State through automation. The Arogya Online of Sawai Man Singh Hospital, (SMS) Jaipur was envisaged to manage critical health related data of Hospital operations including vital patient's records and providing solution to support the Hospital administration. The system was designed to streamline workflow operations by optimisation of tasks to be performed and enable transition to a paperless clinic. The system also sought to facilitate better sharing of information in the Hospital.

The project was entrusted to RajCOMP Info Services Limited (RISL) on 24 March 2007. As per scope of work and budget received, RISL was assigned formulation of work plan, procurement of hardware, third party software and networking. The Application Software and Facility Management System was outsourced to Centre for Development of Advanced Computing (C-DAC), Noida at a cost of ` 5.06 crore. It was scheduled to be completed in three phases by September 2009 as per Service Level Agreement (SLA) between RISL, SMS Hospital and C-DAC. The timeline of the implementation of the project was, however, revised to March 2011.

Audit examined (April-May 2016) related records of SMS Hospital, Jaipur covering the period 2011-16 with the objectives of assessing the effectiveness of the project in developing and integration of various modules as per phase wise plan, streamlining workflow, adequacy of security and controls, disaster recovery and business continuity plan and management of matching hardware. For analysing the security and adequacy of various controls, data for the month of May 2016 as stored and available on the system, was also examined. The operation of HMIS was also test checked in 12 wards[67] of the Hospital.

3.10.2   Audit Findings

3.10.2.1   Project Implementation

Arogya Online project was to be implemented in three phases and a total of 28 modules were required to be developed. In order to computerise patient care

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67   (i) 1C (ii) Special MICU (iii) 3DE *(Medicine)* (iv) Nephrology ward *(Nephrology)* (v) Cardiology ward (vi) CICU *(Cardiology)* (vii) CT ward (viii) CS COMP BMRC *(CT Surgery)* (ix) SW II (x) 2DE (xi) 3AB (xii) 3G *(Surgical).*

delivery system, initially 13 core clinical modules[68] were scheduled to be completed in Phase-I by 9th September 2008 which was revised to 31st August 2009. All Core Modules have been operationalised by October 2011 though certain important features in seven modules were not being utilised. In Phase-II eleven back office modules[69] and four miscellaneous modules[70] in Phase-III were required to be developed by 9th March 2009 and 9th September 2009 respectively. The timelines were subsequently revised to 30th March 2011. Audit found that six[71] out of eleven modules of Phase-II were not developed/operationalised and none of the modules except library module under Phase-III was developed/operationalised.

Deficiencies noticed by Audit in achieving objectives of automation of hospital activities are detailed below:

(i) *Modules were not developed as per Software Requirement Specification*

Review of developed software with Software Requirement Specification (SRS) revealed that the following modules were not developed, as detailed in **Table 3.12**.

Table 3.12

Phases	Name of Module	Purpose	Time Limit of Installation
Phase-II	Appointment and Roster Management	Fixation of Patient appointment and schedules of each Department activities	30/03/2011
Phase-II	Biomedical Engineering Department (BMED)	To provide technical expertise and management support to Hospital administration, engineering department and medical staff	30/03/2011
Phase-III	Health Portal	Portal should have all information specific to SMS Hospital i.e. availability of doctor, patient care charges, contact details, departmental activities etc., on portal.	30/03/2011

The Department, while accepting the facts, stated (July 2016) that these modules will be developed/operationalised within three months. The reasons for delay were not intimated.

(ii) *Non-operationalisation of Modules*

Review of computerisation of the SMS Hospital revealed that out of total 28 modules required to be operationalised as per SRS, six modules under phase II

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68   (i) Emergency Registration (ii) Out Patient (OPD) Registration (iii) In patient (IPD) Management (iv) Outpatient (OPD) Management (v) Enquiry (vi) User Management (vii) Investigation (viii) Billing (ix) Blood Bank (x) Patient Medical Record (xi) Operation Theater (xii) Diet Kitchen and (xiii) Pharmacy Store.

69   (i) Store Management System (ii) Procurement/ Purchase (iii) Central Sterile Services (iv) Personnel Information System (v) Finance Management System (vi) Bio Medical Waste (vii) Transport (viii) Linen/ Laundry (ix) Bio Medical Engineering Department (x) Administrative Module and (xi) Appointment and Roster Management.

70   (i) Right to Information Module (ii) Health Portal (iii) File Tracking System (FTS) and (iv) Library.

71   (i) PIS Module (ii) CSSD (iii) Bio Medical Waste (iv) Linen and Laundry (v) Appointment and Roster Management and (vi) Bio Medical Engineering Department.

and phase III were not operationalised as of July 2016, as detailed in **Table 3.13**.

Table 3.13

S. No	Name of Modules	Purpose	Implication
1	Personnel Information System (PIS) Module (Phase-II)	Information on human resources activities.	Management of personal details of employees was not automated.
2	Central Sterile Services (CSSD) Module (Phase-II)	Online information of sterilisation of equipment, instruments and materials.	No hardware was installed in CSSD Details of equipment, instruments and materials sterilised, shift wise are being maintained manually in CSSD.
3	Bio Medical Waste (BMW) Module (Phase-II)	Monitoring category wise waste into colour coded plastic bags, storage, transportation, collection and final disposal.	Module is not in operation. All records are being maintained manually. Final disposal/ disinfection/treatment of harmful biomedical waste could not be monitored online.
4	Linen & Laundry Module (Phase-II)	Management of clean linen to patients in Hospital.	Washing requirement from various departments could not be made online. Records in laundry section are being maintained manually. Interface with other modules are also disabled.
5	Right to Information (RTI) Module (Phase-III)	Managing RTI process.	This deprived access to online information.
6	File Tracking System (FTS) Module (Phase-III)	Management of movement of files, letters and other documents.	Movement and location of the files not traceable online. Records are being maintained manually.

Due to non-operationalisation of these modules, Hospital operations scheduled for computerisation in respect of these modules were done manually. Department, while accepting the facts, stated (May 2016) that these modules would be operationalised shortly.

Recommendation:

1. The Hospital should operationalise/develop all the modules in order to bring complete automation in entire Hospital operations, so that advantages of a fully automated IT system could be harnessed.

(iii)   Non-utilisation of available features

Review of computerisation of SMS Hospital, Jaipur revealed that though the following modules were developed by the C-DAC, Noida and the modules were operationalised, all the features of these modules were not utilised. This affected the automation process as detailed in **Table 3.14**.

Table 3.14

Category of Phase	Name of Module and date of operationalisation	Purpose	Details of features not utilised
Phase-I	OPD Module 02.04.2009	Providing diagnosis details, patient history, physical examination details, vital from clinical observation file and treatment file.	Patients visit stamping, name of disease for which patients seeking treatment, examination and diagnosis done, treatment provided, instructions given to patients, clinical observations on patient vital parameter, online ordering of investigation, medication, consultation, cross consultation and history of patients.
Phase-I	IPD Module Nursing Desk 02.04.2009	Complete treatment administered during the period of patient's stay in SMS Hospital which included Electronic Orders Processing, Clinical Notes, Clinical Observation, Drug Administration, Discharge Summary etc.	Investigation, packing list, medical equipment, Blood Bank, Doctor Visit, Blood requirement status, Bed management.
	IPD Module Doctor Desk 02.04.2009		Admitted patient history, raising investigations online, packing list, in-Hospital management, discharge preparations, OT advice and stock position on line.
Phase-I	Billing 07.08.2009	Billing of Registration, Admission and Investigation.	Four out of six billing counters in Dhanwantri OPD were not integrated with bar code printer.
	Blood Bank Module 04.05.2010	Providing upto date information about blood/component stock, total daily blood requisitions and information regarding blood/ components, cross matching and infection tests of donors.	Alert in advance of the expiry date of blood/blood components.
	Operation Theatre 08.08.2009	Online information about scheduling of operations, Pre Anaesthesia Clearance (PAC), Dossiers.	Online status of patients, history, PAC and operation details, type of Anaesthesia and Online data generation.
Phase II	Store Management System 27.04.2013	To ascertain needs of all the stores of each department and to provide stores to each department as and when needed.	Consumables and non-consumable items/equipment & tools were not displayed online.
	Procurement and Purchase 03.07.2012	Procurement and management of stock of various consumables and non consumables.	Except medicines and drugs, other consumables and non consumables were not procured/purchased online.

Non-utilisation of features of core clinical modules affected automation of the important hospital activities like operations, online discharge, bed management under IPD management etc. The Department while accepting the facts of non utilisation of the features of the modules stated (May 2016) that diagnosis will be entered by all the Departments shortly in OPD modules. IPD management through Nursing staff will be started after imparting training to them and online discharge will be started soon in five Departments (Medicine, Dermatology, Ophthalmology, Endocrinology and plastic surgery). Further Bar Code will be made available on all counters of Billing and features pointed out by Audit in Blood Bank Module and Operation Theatre Module will be utilised.

(iv)   User Acceptance Test not done

User Acceptance Test (UAT) is executed in the final stage of software development cycle by client. It confirms that the system meets the requirement of the specification. It was noticed that UAT was not conducted in nine modules[72] out of 25 modules developed/operationalised by C-DAC. Reasons for non-conduct of UAT were not intimated by the Department.

(v)   HMIS operating without security certificate

It was seen that Arogya Online was operating without testing of application by the Government approved agency. This was desirable for an e-Governance programme developed by Government agency before making the application operational. This also fulfills the requirement of Third Party Certification for the product in line with National and International Standards.

The Department stated (July 2016) that the matter for obtaining security certificate would be pursued with Standardisation, Testing and Quality Certification (STQC).

(vi)   All hardware not covered under Annual Maintenance Contract

It was decided (January 2011) that RISL would finalise tender for Annual Maintenance Contract (AMC) of all hardware including batteries and networking equipment of Arogya Online Project on behalf of SMS Hospital.

Audit, however, noticed that RISL awarded (February 2012) a Comprehensive Annual Maintenance Contract (CAMC) to a firm for a period of one year at the cost of ` 6.62 lakh which included only networking equipment leaving all other hardware including batteries uncovered in the CAMC.

It is worth mentioning that 561 hardware equipment worth ` 69.43 lakh became condemnable/unusable due to non-maintenance.

(vii)   Hardware lying idle in the store

Audit observed that 94 computers and related hardware costing ` 20.69 lakh supplied (during August 2008 to October 2013) by RISL, were not installed as of May 2016. They were lying idle in the store despite lapse of more than three years of their procurement. Keeping a large number of hardware for long periods without use led to obsolescence due to change of technology. Delay ranging between 6 months to 90 months was also noticed in issue of hardware (706 items) by the store of Data Centre to various units of Hospital.

The Department stated (October 2016) that the configuration of thin clients had become outdated and these equipment along with their connectable devices were now not usable.

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72   (i) Out patient management (ii) Enquiry (iii) User management (iv) Operation theater (v) Procurement/ purchases (vi) Central Sterile Services Department (CSSD) (vii) Administrative Module (viii) RTI and (ix) Library Management System.

Unused Computer Hardware lying idle in Store.

Further, against a provision[73] of physical verification of all stores at least once in a year, physical verification of stores related to Arogya Online project was not conducted after August 2010.

Department, while accepting the facts, stated (July 2016) that the detailed reply would be submitted shortly.

Recommendation:

2. *Hardware equipment should be procured according to the requirement in the project and optimum utilisation of equipment should be ensured. AMC of hardware equipment on regular intervals should also be ensured.*

(viii) Inadequate Training on Arogya Online Project

As per Para 2.21 of Schedule II of Service Level Agreement (SLA), a user level training was to be given to the concerned person at various modules of Arogya Online along with comprehensive one time on-site training on System Administration. Operational level of Application Software training and training on Network Administration was also required to be given for a period of five days each. These training programmes were required to be arranged by the Hospital.

It was observed that only 54 nursing staff and 26 outsourced computer operators were trained during 2008-2009 for Registration module. Other Training programmes were not arranged by the Hospital. Audit observed that none of the nursing staff/doctors of test checked wards[74] were trained for the project.

Due to lack of adequate training, nursing staff were maintaining in-patient's registers[75] manually. Further, activities like raising investigations, prescribing medicines, noting operation details, discharge preparations etc., were also being done by the Doctors manually instead of generating them online.

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73 Rule 12 (1) of General Financial and Accounts Rules, Part II.
74 (i) 1C (ii) Special MICU (iii) 3DE *(Medicine)* (iv) Nephrology ward *(Nephrology)* (v) Cardiology ward (vi) CICU *(Cardiology)* (vii) CT ward (viii) CS COMP BMRC *(CT Surgery)* (ix) SW II (x) 2DE (xi) 3AB (xii) 3G *(Surgical)*.
75 Patient admission register, Diet kitchen register, Linen & Laundry register, Bio-medical waste register and medicine register.

Consequently the objective of transition to a paperless clinic was defeated. Apart from this online functioning of core modules like IPD module, Blood Bank module and Operation Theatre module was also affected due to non-availability of trained clinical staff.

Department of Information Technology & Communication stated (September 2016) that the gains of classroom type of training were limited as the Hospital staff could not be spared during shifts. SMS Hospital shall be advised to ensure that training is made compulsory for the relevant staff before implementation of a module in the Ward/Department.

Recommendation:

3. *All the users and existing manpower of the Hospital should be provided training in order to use the automated systems effectively and reap all its benefits.*

3.10.2.2 Security and adequacy of controls

(i) Application Control

The data of patients was required to be secured through password policy and firewall created on the server. Deficiencies noticed by Audit are elaborated in succeeding paragraphs:

a) Input Control

Input controls are application controls which seek to minimize the risk of incorrect data entry by making validation checks, duplicate checks and other related controls. Though the data of patients was secured through password policy and firewall created on the server but in following instances application deficiencies were noticed in test check months[76] which could compromise the data integrity of HMIS (Arogya Online):

∗ Auto insertion of date and time was not programmed in the system. Analysis of data of test checked months revealed that in 36 cases of discharge from Orthopaedic Department, the system captured incorrect dates *e.g.* date of admission of patients was exhibited 30th September 2015 and date of discharge was shown 8th October 2016 in the report generated on 18th May 2016.

∗ Age of patients was wrongly entered in 102 cases in OPD Registration, which was in the range of 117 years and 820 years and age of 61 patients was entered as zero. 39 OPD patients of age below 20 years were entered in pensioner category.

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76 September 2013, September 2014 and September 2015.

∗ More than one Central Registration (CR) numbers were allotted to the same patient in the OPD registration on different occasions on the same day.

∗ A report was generated by Audit on 10th May 2016 wherein the number of patients in the test checked wards exceeded (ranged between 265 *per cent* and 768 *per cent*) the number of beds available in the ward *(Appendix 3.5)*.

∗ It was also noticed that 28 patients were discharged from Day Care BCC ward while only 24 patients (old patients: 4 and new patients: 20) were admitted in the ward on the day.

b)   *Output Control*

Output controls are the processing controls that ensure that the output is complete, accurate and timely. Instances given below indicated processing of incorrect data:

∗ Patient Statistics Report generated for 2015-16 contained repetition of data in the five categories[77] of patients which resulted in fictitious increase of 16.84 lakh patients in the report.

∗ Blood Bank module generates various reports such as Daily Blood Stock Book, Balance Sheet of Blood Bank, Blood Donor Register Report, Registered Donor Blood Group wise report and registered donors type wise reports. Audit noticed discrepancies in data of the number of Donors generated during March 2016 from three different reports as given in **Table 3.15**.

Table 3.15

Donors	As per Blood Donor Register report	Registered Donor Type wise	Registered Donor Blood Group wise
Without Biometric	4254	3097	4862
With Biometric	634	639	

Source: Reports generated during March 2016.

It is seen from the table that the data of the number of donors during March 2016 did not match in Blood Donor Register Report, Registered Donor Type wise reports and Registered Donor Blood Group wise reports.

Department of Information Technology & Communication stated (September 2016) that the SMS Hospital shall be advised to ensure that the observations of Audit are incorporated to make the system more robust.

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77 Below Poverty Line, Handicapped, Pensioners, Senior Citizens and Paid (Auto Finance Scheme)

(ii)   Validation Controls

Validation controls ensure completeness and authenticity of data captured. Instances given below indicate lack of data validation.

∗   As per medical standards given in Drugs and Cosmetics Rules 1945, persons in the age group of 18 to 60 years could only donate blood. Analysis of data of selected months revealed that in three cases the age of donors was below five years and in 11 cases it ranged between 61 years to 459 years. It is evident that no controls existed to map age.

∗   Senior Citizens OPD patients (age 60 years and above) were required to be categorized in exempt category whereas, 36,095 Senior Citizens were categorized in *'Paid Auto Finance Scheme (AFS)'*. Thus, registration charges of ` 1.80 lakh at the rate of ` 5 each were wrongly recovered from these patients inspite of being exempted.

∗   *Male child'* and *'Female child'* were categorised wrongly under the category of *'Senior Citizens', 'Pensioners', 'Widow', 'Journalist'* and *'Prisoner'* in patient statistics report generated (Registration of Patients) for the period April 2015 to March 2016.

The Department, while accepting the facts, stated (July 2016) that the validation controls mentioned by Audit have been incorporated. Detailed reply will be submitted shortly.

(iii)   Discrepancies between report generated on the system and records maintained manually

The data of in-patients in the 12 selected wards was extracted in the report generated on the system on 31st March 2016. It showed 353 patients whereas the records maintained manually in the wards showed 628 patients. Thus, there was discrepancy in the number of in-patients exhibited by the system and the records maintained manually. The details are given in ***Appendix 3.6.***

Reply of the Department is awaited (December 2016).

> *Recommendation:*
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> 4. *Adequate application controls and validation controls should be exercised to minimise the errors in the critical health related data.*

3.10.2.3 *Ineffective Business Continuity and Disaster Recovery Plan*

Effective Business Continuity and Disaster Recovery Plan are important to ensure that the organisation does not lose the capability to process, retrieve and protect information maintained in the event of an interruption or disaster

leading to temporary or permanent loss of computer facilities. It was observed that the Business Continuity and Disaster Recovery Plan were not framed in SMS Hospital and the documented backup policy had not been put in place. The Department, while accepting the facts, stated (May 2016) that Disaster Management Plan will be developed shortly in Trauma Centre/Dhanwantri OPD block of the Hospital and equipment required for the Disaster Recovery Management would be procured after approval of the executive committee.

Recommendations:

5. Department should formulate a Business Continuity and Disaster Recovery Plan and ensure its strict compliance so that it can smoothly resume its operations in the event of any interruptions.

3.10.3   Conclusion

Arogya Online project has benefitted both out patients and in-patients due to automation of some of the critical hospital activities, however, non-operationalisation/delayed development of certain modules for operation theatre, bio-medical waste, linen & laundry, sterilisation of equipment etc., has resulted in not harnessing most of the advantages of a fully automated IT system. Manual preparation of the reports and patients' register by the hospital staff defeated the objective of transition to a paperless system.

In absence of proper planning for procurement of hardware and non execution of AMC, large number of hardware equipment became condemnable and were lying idle. Comprehensive and time bound training for acquaintance with HMIS applications was not imparted to all the users. Lack of adequate application controls and validation controls resulted in feeding of wrong patient data into the system which compromised the reliability of database. Moreover, Disaster Recovery and Business Continuity Plan were not formulated to meet the threat to the information.

Higher Education Department

3.11   Non-recovery of sports infrastructure fee and penalty

Sports Infrastructure fee and penalty was not recovered from affiliated colleges due to non-compliance of instructions of BoM and non-maintenance of proper/effective records.

The Board of Management (BoM), University of Kota (University) resolved (May 2005) to increase the Sports Infrastructure (SI) fee from ` 50 to ` 100 per regular student from session 2005-06. Out of this, ` 50 was to be kept by the College and remaining ` 50 would be sent to the University for the