Case Study

Hospital Management Information System, Gujarat

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EXECUTIVE SUMMARY

The Hospital Management Information System has been envisaged to help health administrators in Gujarat to exercise an enhanced monitoring control over the functioning of government hospitals by using decision support indicators, to assist doctors and medical staff to improve health services with readily reference patient records and a work flow enabled less-paper process and to provide efficient and timely treatment to patients through automatic alerts during patient treatment cycle.

Prior to the HMIS, the absence of a coherent management system made the monitoring of diversely located hospitals difficult. Senior level officials were unable to keep adequate track on usage of funds and to record development on various health indicators of the state. At the same time, hospitals were facing day to day operational challenges and inefficiency in patient handling services resulting in wastage of time, manpower and money and a non-transparent and unaccountable working environment.

Through the efforts of the Commissionerate of Health & Family Welfare and Medical Education, the Health & Family Welfare and Medical Education Department of GoG and Tata Consultancy Services Ltd., government hospital processes in Gujarat were re-engineered. This process of re-engineering included the creation of a system of online registration, simplification of diagnostic process through single sample collection, setting up of standardized administrative formats, setting up online inventory management, adoption of standardized biomedical waste management and the proper management and allocation of human resources under the HMIS.

HMIS began as a pilot in four hospitals in 2006, by March 2008 the new system became live in all 30 government hospitals across the state.

With the HMIS, the loopholes in the operations of government hospitals throughout Gujarat are sought to be addressed. HMIS has enabled the provision of better care to patients by automating all the major functional areas of government hospitals. It is also facilitating the monitoring of pre-defined health indicators by generating periodic reports for the hospital management as well as state level administrators.

Gujarat’s HMIS solution presents various lessons to be learnt while deploying complete IT based systems in replacement of manual processes. Gujarat’s experience highlights the importance of developing streamlined processes for hospital administration and displays the
role that technology can play. At the same time it stresses on the importance of introducing behavioural changes parallel to technological change of any kind.

**BACKGROUND**

Majority of government hospitals in India operate on manual processes, which create major inadequacies in managing patient information and unnecessary delays in a patient’s treatment cycle. At the same time, manual processes result in non-uniform and non-standardized handling of hospital administration related logistical data, improper inventory management, fund management and allocation and present numerous challenges in conducting supervisory and monitoring activities. Such challenges in day to day hospital administration and monitoring activities reflect the crucial need to introduce standardized automated processes and tools for managing the vast amount of information in government hospitals and meet the demands of modern healthcare delivery.

Recognizing this need, the Ministry of Health & Family Welfare and the Ministry of Communication and Information Technology have issued guidelines and are working jointly towards the creation of a national public health information infrastructure that will enable efficient capturing and dissemination of standardized health information and ensure the delivery of quality health services. Based on these guidelines, various states like Maharashtra, Delhi, and Gujarat etc. have devised their own unique IT based solutions to streamline hospital management.

This document aims to study the Gujarat model of managing hospital information and analyzes the impact of this model on the day to day functioning of district hospitals in Gujarat and details the challenges that this new automated system faces.

The Health and Family Welfare Department (HFWD) of the Government of Gujarat (GoG) launched the Hospital Management Information System (HMIS) in 2006, in order to improve the delivery of quality health services in the state. The HMIS has been envisaged to help health administrators have better monitoring and control over the functioning of government hospitals across the state by using decision support indicators, to assist doctors and medical staff to improve delivery of health services with readily reference patient records, a work flow enabled less-paper process and to create an efficient and timely patient treatment cycle through automatic alarms.

Gujarat has 30 district hospitals which are classified as minor and major hospitals. Non-teaching hospitals are termed as minor and teaching hospitals as major. In all, there are 24 non-teaching hospitals and 6 teaching hospitals. Prior to the HMIS, the absence of a coherent...
management system made the monitoring of these diversely located hospitals difficult. Senior level officials were unable to keep adequate track on the usage of funds and record development on various health indicators of the state. At the same time, hospitals were facing day to day operational challenges and inefficiency in patient handling services resulting in wastage of time, manpower and money along with the creation of a non-transparent and unaccountable working environment.

With the HMIS, these shortcomings in the operations of government hospitals throughout Gujarat are being sought to be addressed. HMIS has enabled providing better care to patients by automating all the major functional areas and the entire gamut of hospital activities. It is also enabling the monitoring of pre-defined health indicators by generating reports and facilitating decision making by the hospital management as well as state level administrators.

HMIS began as a pilot in four hospitals in 2006, by March 2008 the new system became live in all 30 government hospitals across the state.

**METHODOLOGY**

The Governance Knowledge Centre (GKC) documents best practices in governance in India in support of further replication. For this purpose, select initiatives that are significantly contributing towards the betterment of public service delivery are identified by the GKC research team. The team conducted extensive secondary research using credible web sources to establish the suitability of the Hospital Management Information System (HMIS) as a best practice. This research reflected that the HMIS model of Gujarat holds vast potential for introducing a culture of efficient and transparent functioning in public health utilities across the state.

Having recognised HMIS as an innovative ICT based solution for effective hospital management the next step was to identify the key stakeholders involved in the project and schedule interviews with them to gain a deeper insight into the operation and impact of the effort. For primary research, the GKC team conducted semi-structured interviews with the HMIS team at the Health & Family Welfare and Medical Education Dept, GoG and also visited the Gandhinagar District Hospital to witness system usage and hold discussions with the hospital administration. This document has been compiled by putting together insights gathered during this field visit as well as the information collected through secondary research.

Efforts have been made to provide objective information in the document. However, since only the implementers of the project were interviewed, there is a possibility of percolation of information bias. Furthermore, since the team visited the Gandhinagar District Hospital - a site
for the pilot of HMIS, the possibility of variation in performance of HMIS in hospitals located further away in remote districts exists. This variation in performance must be factored in while referring to the analysis presented in this case study.

**OBJECTIVE**
The Hospital Management Information System introduced in government hospitals across the state by the Government of Gujarat (GoG) aims to:

- Improve patient care and record management
- Streamline operations and improve administrative and control functions
- Facilitate pro-active monitoring of quality health service indicators
- Provide an integrated state-level holistic view of resource utilization

**PROJECT DESIGN**

**Key Stakeholders**
- **Health & Family Welfare and Medical Education Dept, GoG:** The HFWD provides healthcare facilities and administers public health policies in the state.
- **Commissionerate of Health & Family Welfare and Medical Education, GoG**
- **Administrative staff and doctors of district hospitals**
- **Patients and their relatives**
- **Tata Consultancy Services (TCS) Ltd:** The complete IT solution provider for deploying the HMIS in the state.

**Process Flow**
For the efficient management of government hospitals and to deliver quality health services, the HFWD required the deployment of an integrated information system which would provide a holistic view of the functioning of all processes in these hospitals. Hence the HMIS was conceptualized to provide standard clinical and diagnostic tools, hospital management tools and a management information system for ensuring online review and monitoring of hospital performances. The Government of Gujarat selected TCS to deploy the HMIS in its district hospitals because of its in-depth domain expertise. The deployment of HMIS in Gujarat took place after need assessment study was carried out by TCS to determine the components and scope of the new system.
Designing and deploying the HMIS

Based on the results of the need assessment study, the TCS team developed a state-of-the-art IT based solution that addresses the entire gamut of hospital activities. The HMIS was developed on .NET technology with the SQL Server 2005 as the backend. Two TCS associates were placed for a period of one year at the six major teaching hospitals and one associate at the 24 minor hospitals to gradually deploy the new system, introduce and train the hospital administration and supervisory staff into using the HMIS for their day to day activities. In cases where one year was not sufficient, the tenure of the associates at the hospitals was extended to make the hospital staff well versed with the new technology.

Modules and usage of software

The HMIS software has 30 modules covering patient, clinical, administrative and ancillary services.

<table>
<thead>
<tr>
<th>Patient Care Services</th>
<th>Clinical Services</th>
<th>Hospital Admin</th>
<th>Ancillary Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Registration</td>
<td>· Clinical EMR</td>
<td>· Hospital Admin</td>
<td>· National Programs</td>
</tr>
<tr>
<td>· Wards</td>
<td>(Gynecology, Ophthalmic, Orthopedic, ENT, General Medicine)</td>
<td>· Human Resource</td>
<td>· Linen Management</td>
</tr>
<tr>
<td>· Pharmacy</td>
<td>· Pediatric, Surgery, Skin, Dental etc...</td>
<td>· Payroll</td>
<td>· Equipment Maintenance</td>
</tr>
<tr>
<td>· Billing</td>
<td>· Laboratory (Pathology, Microbiology, Bio Chem, Radiology)</td>
<td>· Financial Accounting</td>
<td>· Resource Scheduling</td>
</tr>
<tr>
<td>· Patient Education</td>
<td>· Blood Bank</td>
<td>· Stores/Inventory</td>
<td>· Special Camp &amp; Training</td>
</tr>
<tr>
<td>· Information Kiosk</td>
<td></td>
<td>· Purchase</td>
<td>· Bio Medical Waste</td>
</tr>
<tr>
<td>· Nursing Care</td>
<td></td>
<td>· Complaints &amp; Redress</td>
<td>· Application Security</td>
</tr>
</tbody>
</table>

**Figure 1: Services covered under the HMIS**

**Source:** Tata Consultancy Services
These modules cover the entire gamut of hospital activities from patient registration, doctor allocation, medical prescription, clinical tests, inventory management, and hospital human resource management, waste management, running of national and state schemes and overall monitoring functions.

**Figure 2: Workflow of HMIS Showing the Day to Day Usage of the Software**

*Source: Tata Consultancy Services*
TECHNOLOGICAL FEATURES

As mentioned earlier, HMIS is built on the .NET technology with the SQL Server 2005 as the backend. The HMIS solution has three tier distributed architecture accessible over GSWAN. Crystal reports and SQL Reporting services are used for the reporting purpose. The three tier architecture enables the easy replacement of any tier without affecting the other two tiers. A central server is connected to the local servers of each hospital. The local servers operate independently and push in data at the end of the day to the central server. Such a decentralised architecture makes it possible for the software to function independently across hospitals without making it vulnerable to centralized fluctuations.

The main features of the HMIS software are:

- It is a web based and workflow based application
- It provides customized clinical data
- It allows doctors to follow advanced medical prescription patterns
- It enables faster diagnosis with ready-made templates
- It can be integrated with smart card and barcode technology
- It allows for extensive MIS based reporting facility
- It is built in compliance to international and national standards like ICD-10: International codification for diseases, HL7: Messaging standard, DICOM: Imaging standard
- It allows for defining authorization rights for critical transaction approvals in order to enhance security levels and prevent unauthorized access to the system
- It is open to high level of configuration and can be easily customized as per the need of the hour
- It is integrated with international hospital accreditation standards like National Accreditation Board for Hospitals (NABH)

Monitoring and Evaluation

The major highlight of the HMIS software is its ability to provide detailed monitoring reports for various levels of hospital operations. The system generates customized reports as per the concerned monitoring authority’s necessity. At the state level it generates various reports for...
the Commissioner of Health who has the flexibility to define his/her own MIS home page and request customized data. The software is also capable of generating visual alarms for clinical/non-clinical parameters. It provides a state level comparative map for cross measuring of the performance of various district hospitals on various parameters. It provides data related to the drug status in all district hospitals as well as highlights the disease trends.

At the hospital Level it provides customized dashboard reports for officials as per need. It highlights administrative, medical, infrastructural and financial data. It provides information for grading a hospital’s monthly performance. It also highlights the disease trend in a particular hospital, presents easily accessible patient statistics, system usage trend summary and provides customised reports for the Chief District Medical Officer as per his/her requirement. In this manner HMIS is enabling holistic monitoring of district hospitals in Gujarat both at the district and state level.

**Capacity building**

TCS has deployed a champion team at district hospitals to train the administration and hospital staff in using and troubleshooting the software. This team consists of TCS associates and an IT person from the IT cell of the HFWD. TCS is constantly available for providing maintenance support to district hospitals and the HFWD and ensuring the smooth usage of the software.
Financial Resources

The HFWD spends three percent of its annual health budget on I.T. HMIS was financed out of this budget. The major costs of operation under HMIS include: software development, hardware deployment, training and networking of hospitals and software maintenance and upgradation costs.

IMPACT

The HMIS is contributing towards the creation of a robust public healthcare system in Gujarat. It is benefiting state level monitoring authorities, doctors and hospital administration as well as patients.

On state-level monitoring authorities
The HMIS provides a state-wide holistic view of hospitals’ day-to-day functioning. Through its MIS the software facilitates monitoring of pre-defined health indicators and enables decision-making on key health issues in the state by making available real time data. Such easy and quick availability of various reports and data helps in identifying areas for improvement, studying disease trends and introducing a culture of efficient and transparent functioning across district hospitals in the state. It has replaced the tedious and inadequate manual reporting system with a highly efficient and reliable tech-based system which helps state level monitoring authorities perform their duties adequately.
On doctors and healthcare staff

The HMIS is improving day to day hospital operations. It has increased efficiency of doctors due to easy access to electronic medical records, templates for treatment recording cycle and ICD10 codification support. It has reduced time-to-serve patients and is enabling the provision of quality patient care. At the same time it has streamlined the daily functions of various hospital staff, nurses, pharmacists etc. and in resulting in their efficient performances. In this manner, it is saving daily operational costs as well as unnecessary wastage of time and effort by putting in place standardized and uniform processes.

On citizens

Patients at district hospitals are also reaping the benefits of this new technology based information system. Patients can now avail efficient health services at hospitals due to a digitized history of records, save time per visit, pay standardized charges and easily seek information about doctors through the information kiosk in the local language. These facilities help the patients coming to district hospitals avoid the general chaos that they would otherwise face and avail healthcare services in a...
streamlined and timely manner. In this manner, the pressure on the hospital administration is also reduced.

**CHALLENGES IN IMPLEMENTATION**

**High cost of software development**
While HMIS holds vast potential in improving healthcare delivery and management, a major road block in its way is that the cost of developing the software is on the higher end. Given this, the deployment and improvement of the software over time has been highly challenging. This factor is also limiting the up-scaling of the system to the entire public healthcare system till the village level. While policy makers are convinced of the need to build a health IT infrastructure, the high costs involved often delay and limit their acting power.

**Difficult to migrate from manual processes**
The manual processes at work in government hospitals were installed decades ago, hence the staff as well as patients are used to these processes and are being unable to speedily cope up with the new system. The transition from manual processes to this IT based system is a long drawn and gradual process, which presents numerous challenges in adequately deploying and using the new system. Perhaps a way out would be to roll out the new system in phases and prepare both service providers and beneficiaries for the bigger changes to come.

**Lack of tech-enabled medical personnel**
The lack of IT friendly medical personnel is presenting several challenges in the successful running of the HMIS. Though data entry operators have been provided at select hospitals, they do not present a permanent solution as it involves incurring greater costs. Efforts have to be made to adequately and frequently train medical personnel and convince them about the need to use the IT based system and aware them about the advantages it can accrue.

**Huge influx of patients**
The large volume of patients coming to government hospitals makes the process of migrating to automated processes highly difficult. They do not have the patience to wait for registration and data entry and often fail to understand the functioning of automated processes; hence they adopt an uncooperative stance often resulting in disillusioning the hospital staff about the overall usage of the HMIS.

All the above challenges can be addressed through proper awareness generation efforts and gradual roll-out of the software instead of a complete roll-out at a go.
SUSTAINABILITY

Overcoming the above challenges can make the HMIS sustainable in the long run. While the initiative enjoys the support of service providers, a vast scope for improvement remains in terms of patient awareness generation. At the same time, the initiative needs to display its resilience to on-site challenges and adapt accordingly. Many components of the system remain unused due to challenges mentioned above; perhaps a simpler version of the software needs to be developed instead of all encompassing software. Such a step can introduce both service-providers and citizens to the new system and prepare them over time for a much more detailed IT based system. Furthermore, a gradual roll-out will also ensure the financial viability of the system. It is crucial to bear in mind that technological change has to be superseded by stakeholder preparedness and participation in the change management process.

POTENTIAL FOR REPLICATION

HMIS currently runs only in district hospitals of Gujarat. There is a vast scope for up-scaling the initiative to cover the entire public health system in Gujarat. However, this up scaling process has to be based on developing solutions for the challenges being faced currently and deploying various components of the software in a step by step gradual manner. The experience of HMIS across district hospitals reflects that the successful introduction of such systems in a detailed health care set-up requires behavioural changes, which is a time consuming process. While technologically the system is sound, it has to be complemented with adequate change management training and awareness generation failing which the solution will prove to be of limited usage.

CONCLUSION

Gujarat’s HMIS solution presents various lessons to be learnt while deploying complete IT based systems in replacement of manual processes. Gujarat’s experience highlights the importance of developing streamlined processes for hospital administration and displays the role that technology can play. At the same time it stresses on the importance of introducing behavioural changes parallel to technological change of any kind. Over the years, HMIS has received several awards which point towards the relevance and potential of the initiative. Some of these awards include: EDGE Award 2010, Bronze medal for HMIS, National E-governance award (2008-09), Scotch Challenger Award for HMIS (2007-08) and CSI Nilihent (Computer Society of India) Award for HMIS (2007-08).
REFERENCES


APPENDIX A – INTERVIEW QUESTIONNAIRE

Background

1. Why was the need to develop the Hospital Management Information System (HMIS) felt? How was the functioning of hospitals in Gujarat being monitored and overseen before the HMIS?
2. The HMIS seeks to facilitate monitoring of government hospital functioning across Gujarat and use ICT to ease day to day operations of the hospitals. What are the specific objectives of HMIS?
3. How do you think an ICT based system is an improvement over earlier mechanisms to supervise hospital functioning in the state?

Key Stakeholders

4. The key stakeholders in HMIS are
   Health & Family Welfare and Medical Education Dept, GoG,
   Commissionerate of Health & Family Welfare and Medical Education, GoG,
   Administrative staff and Doctors of the hospitals, Citizens (Patients & their relatives),
   Total Solution Provider (Tata Consultancy Services Ltd.) What are the roles and responsibilities of each of these stakeholders?
5. Why was a private service provider selected to develop HMIS?

Process Flow

6. A need assessment study was conducted prior to the development of HMIS. Who conducted this assessment and what were its results?
7. As per our research, a pilot was conducted to test the feasibility of HMIS in monitoring hospital operations in Gujarat.
8. What was the duration of this pilot? On what basis were the pilot hospitals selected? Can you elaborate on what the pilot phase entailed?
9. What were the findings/conclusions/results derived from the pilot project?
10. When the pilot was up scaled to cover the remaining hospitals of the state?
11. Which parameters of hospital operations does HMIS seek to improve?
12. Please explain the role based usage of HMIS by the a) hospital management b) by patients and their relatives c) by monitoring authorities with the help of an example.
Technology

13. TCS developed HMIS. What are the main technological components of this system? Can you elaborate on the software used? Are they open source or propriety? Please explain the reason for the choice of either?
14. HMIS has been in operation since 2006. Has the technology been modified over time? If yes, which areas have the modifications been made in?
15. A stakeholder need assessment is done twice a year to get user feedback. Who conducts this assessment? What parameters are assessed through this study? What are the major findings of this assessment over the years?

Capacity Building and awareness creation

16. The hospital management and monitoring authorities were given any training on the use of the software. Please provide details of the training provided: resource persons, participants, exact content, methodology, duration, follow up mechanisms adopted.
17. How have officials responded to the introduction of a transparent ICT led monitoring system? Is there any resistance? If yes, how is it being overcome?
18. What efforts were made to generate awareness among citizens about HMIS? Were there any difficulties in this process, given the low level of computer literacy?

Monitoring

19. Who is responsible for monitoring the adequate usage of HMIS?
20. When HMIS shows an underperforming hospital and discrepancies in operations, who is responsible for taking corrective action?

Financial Model

21. How were the funds for HMIS procured? What were the major heads of expenditure in setting up HMIS?

Impact

Achievements

22. What are the major achievements of HMIS? What has been its impact on:
23. Government hospitals
24. Monitoring Authorities
25. Service delivery procedures
26. Patients

Challenges
27. What are the major challenges faced in the implementation of HMIS? How are they being overcome?

Enhancements
28. What are the major enhancements planned for the future for HMIS?
29. Have any other states showed interest in replicating HMIS? What do you think are the necessary preconditions for the success of such an initiative?

Data
30. Can you provide us with the following data over a period of time?

<table>
<thead>
<tr>
<th>Data Category</th>
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<tbody>
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<td>No. of Users</td>
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<tr>
<td>No. of Modules</td>
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<tr>
<td>Size of Database</td>
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<tr>
<td>No. of Non Teaching Hospitals covered</td>
<td></td>
</tr>
<tr>
<td>No. of Teaching Hospitals covered</td>
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</tr>
<tr>
<td>No. of registrations</td>
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</tr>
<tr>
<td>Average No. of Transactions</td>
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<td>No. of Users Trained</td>
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