Evaluation of Radiology Information Systems including PACS at Two Tertiary Hospitals in India from User's Perspective

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Abstract

Today there has been growing global emphasis on the need for Hospital Management Information Systems (HMIS). Plethora of studies have shown the benefits of implementing HMIS. The RIS is a subset of HIS which is smaller in scale.

Method: A comprehensive descriptive qualitative study was undertaken from April 2012 to December 2012. The study setting involved two tertiary care public hospitals (main hospital and an associated hospital) located at different and distant locations in the same city. All the consultants in the department of radiology (11) were interviewed except one who was not available during the period of study and Convenience sampling was used to select other Key Informants. A Structured questionnaire was used to evaluate various aspects of RIS & PACS from the end user's perspective.

Results: Overall performance of RIS at main hospital was rated as Satisfactory by 55 percent, neutral by 35 percent and very satisfactory by another 10 percent of the respondents.

Overall performance of RIS at associated hospital was rated as Dissatisfactory by 25 percent, neutral by 70 percent and satisfactory by rest i.e., 5 percent.

Discussion and Conclusion: The user feedback is very important for the success of Hospital Management Information Systems, Radiology Information and PACS. The end user should be involved in the decision to introduce technology at the hospital

Keywords: *Hospital Information Systems, Radiology Information Systems, PACS.*

Introduction

Today there has been growing global emphasis on the need for Hospital Management Information Systems (HMIS)[1]. Plethora of studies have shown the benefits of implementing HMIS[2,3,4,5,6]. The RIS is a subset of HIS which is smaller in scale. RIS equipment consists of a computer system with peripheral devices such as RIS workstations.[7] A picture archiving and communication system (PACS) is a computerised means of replacing the roles of conventional radiological film: images are acquired, stored, transmitted, and displayed digitally.[8] PACS is becoming a standard component for radiology or hospital information system [9]. The evaluation of RIS and PACS implementation has been done from various perspectives. [10] Various studies also stated that user acceptance is an essential tool before implementing PACS as it greatly determines the success rate.

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Methodology

A comprehensive descriptive qualitative study was undertaken from April 2012 to December 2012. The study setting involved two tertiary care public hospitals (main hospital and an associated hospital) located at different and distant locations in the same

city with same radiologists working on rotation basis but different technicians. Both the hospitals were under the same top management control. All the consultants in the department of radiology (11) were interviewed except one who was not available during the period of study and Convenience sampling was used to select other Key Informants: Clinicians (10), Technicians (6), IT Support Team (4), PACS Engineer (1). A Structured questionnaire based on Likert Scale was used to evaluate various aspects of RIS & PACS from the end user's perspective.

Results

Following were the results of the responses received regarding the Radiology Information System (RIS):

User Satisfaction: Overall75 percent of the end users were satisfied with the performance RIS/HMIS.

Availability: About 90 percent of respondents were satisfied with the availability of RIS/HMIS online and said that the downtime of the RIS/HMIS was very less.

IT failure and Emergency Management: 45 percent of the respondents were happy with the response to IT failure and the management of contingencies via IT Department.

Data Protection and Authorization: 40 percent of the respondents were happy with the safety of the data as well as the authorisation procedures to access the data.

Clinical Document Availability: 60 percent of the respondents were satisfied with the kind of availability of the patient related clinical documents on RIS.

Legal Guidelines: 60% of the respondents were not satisfied with the kind of legal guidelines available regarding the use of RIS/HMIS. The matter of the fact was that the legal protocol was not made available to the staff and they were not oriented to these aspects as well.

Response Time: Around 65 percent of the respondents were satisfied with the response time of the workstations as well as the software programme used in RIS.

Completeness and Correctness: Around 85 percent of the respondents were satisfied with the completeness and correctness of the information made available through the RIS.

Functional Range: Majority of the users (around 60 percent) were happy with the functional range of the modalities made available through the RIS.

Redundancy: 45 percent of the respondents were not aware of the kind of redundancy available with RIS in the hospitals. The respondents (40 percent) who were aware of this fact were dissatisfied with the redundancy of the database.

Support of Interface Standards: 55 percent of the respondents were not aware of the support of the Interface Standards. Those aware of this fact (30 percent) were not satisfied with them.

Ergonomy and Uniformity: Around 45 percent of the respondents were satisfied with the kind of human-factor engineering (ergonomics) used in the Department.

Sustainability of Vendor: 50 percent of the respondents were not satisfied with the type of vendor support provided. This was true for the PACS only as rest of the RIS/HMIS was developed in-situ.

Continuity of Workflow Support: 25 percent of the respondents were happy with the kind of workflow support provided by the RIS/HMIS and PACS.

The workstation is an important component of RIS. Following responses were obtained regarding the workstations:

Overall Performance: 50 percent of the end users were satisfied with the performance of the Workstations in the Department at both the hospitals

Speed: 40 percent of the end users were satisfied with the speed of workstations in both the hospitals.

Image Quality: 65 percent of the end users were satisfied with the quality of the images made available via the PACS and 20 percent were very satisfied.

User Interface ease of use: 60 percent of the end users were very happy with the user interface provided via HMIS/RIS at both the hospitals.

Login procedure: 60 percent of the end users were satisfied with the login procedures for HMIS/RIS workstations. It is important to remember that the end users got individual passwords and the electronic trail was easy to decipher in both the hospitals.

Worklist Performance: Around 40 percent of the end users were satisfied with the kind of worklist support

and the scheduling support provided by the RIS with 25 percent being highly satisfied.

Navigation, Patient & Study Search: Around 35 percent of the end users were happy with the navigation and search support provided by the RIS/HMIS at both the hospitals.

Retrieval of previous studies: Around 45 percent of the end users were happy with the availability of the previous studies through HMIS/RIS.

Image viewing facilities: Around 65 percent of the end users were happy with the image viewing facilities made available via the RIS/HMIS and the PACS server.

Image zoom functions: Zooming of image is necessary to arrive at the findings sometimes. Around 60 percent of the end users were satisfied with such facilities.

Length and angle measurements: 60 percent of the end users were satisfied with the length and angle measurement facilities provided by the RIS/PACS.

Mirror/Rotate: 65 percent of the end users were happy with the mirror/rotate functionality made available by RIS/PACS.

Image annotation: 65 percent of the end users were satisfied with the Image annotation facility available with RIS/PACS.

Cine-mode, scroll through a series of images: 30 percent of the end users were satisfied with such functionality of the RIS/PACS.

Synchronisation of two images: Only 25 percent of the end users were satisfied with the available facilities.

Synchronisaion of a current and previous examination: 30 percent of the end users were dissatisfied with the synchronisation facility available through RIS/PACS.

Report Generation: 70 percent of the end users were happy with the report generation facility available with the RIS/HMIS.

Dictaphone: 35 percent of the end users were dissatisfied with the Dictaphone facility available with RIS/PACS. Only one consultant was using the Dictaphone services in the department.

Computer Aided Diagnosis: 60 percent of the end users were very dissatisfied with the Computer Aided Diagnosis (CAD) services available with the RIS/PACS.

The following responses were obtained regarding the reading room:

Location: 30 percent of the end users were satisfied with the location of the reading room in radiology department.

Space: 45 percent of the end users were satisfied with the space available with the reading room.

Layout: 45 percent of the end users were satisfied with the layout of the reading room.

Lighting: 40 percent of the end users were happy with the facilities for lighting up the reading room. 10 percent of the respondents were very satisfied.

Noise Level: 45 percent of the end users were satisfied with the level of noise control in the reading room.

Temperature: 50 percent of the end users were satisfied with the room temperature maintenance.

The following responses related to the Ergonomics:

General Comfort: 35 percent of the end users were dissatisfied with the general comfort levels in the reading room.

Table layout & Space: 40 percent of the end users were satisfied with the table layout and the space available.

Keyboard, mouse and other device placement

50 percent of the end users were dissatisfied with the way Keyboard, Mouse and other devices were placed on the table tops. Only 15 percent of the end users were satisfied with this arrangement.

The user's faced the following problems:

Irritation/Itching/Strain of Eyes: 20 percent of the end users did not experience any irritation, itching or strain of eyes. 10 percent of the respondents experienced irritation, itching and strain of eyes after prolonged sitting hours on workstations.

Pain in Fingers: 25 percent of the end users did not experience pain in the fingers as typing related work was very limited in the HMIS/RIS and PACS. 10 percent

of the respondents experienced pain in fingers after prolonged workstation usage.

Backache: 30 percent of the end users did not experience any backache. 10 percent of the respondents complained of the backache after working on the RIS/ HMIS and PACS workstations.

Pain in Neck: 10 percent of the end users experienced pain in the neck after prolonged use of the workstations. 30 percent of the users did not experience any such symptoms.

Other postural problems: 10 percent of the end users experienced other postural problems. 20 percent of the respondents did not experience any posture related problems. The posture related problems were correlated with the number of hours spent on the workstations as well as the age of the respondents.

The responses for workflow support were as follows:

Image reading & writing:: 40 percent of the end users were satisfied with the kind of workflow support provided by HMIS/RIS and PACS for image reading and writing.

Clinical Conference: 45 percent of the end users were unhappy with the kind of support provided for the clinical conferences. Infact, 25 percent of the respondents were very dissatisfied and remarked that HMIS/RIS and PACS seldom comes handy during clinical conferences.

Image presentation at Clinical Conference: 50 percent of the end users were disappointed with the kind of support provided for Image presentation at clinical conferences by the HMIS/RIS and PACS.

Emergency: 30 percent of the end users were dissatisfied with the workflow support for the emergency. Another 30 percent of the respondents were very dissatisfied with the available workflow support in case of casualty. Only 15 percent of the end users were satisfied with the available facilities.

Wards: 30 percent of the end users were dissatisfied with the kind of workflow support available for the wards. 35 percent of the respondents were very dissatisfied. Only 20 percent of the end users were satisfied with the workflow support available for the wards.

Outpatient Clinics: 30 percent of the end users were dissatisfied with the workflow support available for the Outpatient Clinics. 40 percent of the respondents were very dissatisfied. Only 15 percent of the respondents were satisfied with the workflow support provided by HMIS/RIS and PACS for the Out patient Clinics.

The responses to the system integration between both hospitals:

Radiology Systems of two hospitals: Only 5 percent of the respondents were satisfied with the issue of integration of HMIS/RIS at both the hospitals.

RIS with HIS of same hospital: 15 percent of the end users were dissatisfied with the integration of HMIS and RIS in main hospital as well as in associated. Another 10 percent were very dissatisfied.

RIS of one with HIS of another hospital: 45 percent of the end users were very dissatisfied with the end result of the integration of RIS of one hospital with the HMIS of another hospital.

RIS with PACS of the same hospital: 20 percent of the end users were dissatisfied with the integration of RIS with the Patient Administration System (PAS) in the same hospital be it main hospital or associated hospital .

RIS of one hospital with another hospital: 40 percent of the end users were dissatisfied with the outcome of the integration of RIS of main hospital with the associated hospital and vice-versa. Another 35 percent of the respondents were very dissatisfied with the end result of such an integration.

RIS with DIS of the same hospital: 20 percent of the end users were dissatisfied with the way in which the integration between RIS and the Diagnosis Information System (DIS) worked. Another 10 percent were very dissatisfied with the outcome of such anintegration.

RIS of one hospital with DIS of another hospital: 40 percent of the end users were very dissatisfied with the outcome of the integration of RIS of one hospital with DIS of another hospital. Another 25 percent of the respondents were dissatisfied with the end result of integration of RIS of main hospital with DIS of associated and vice-versa.

RIS with EMR of same hospital: 35 percent of the end users were dissatisfied with the outcome of integration of the RIS with Electronic Medical Records (EMR) of the same hospital be it main hospital or associated

hospital. Another 10 percent of the respondents were very dissatisfied with such an integration of RIS/HMIS and EMR.

RIS with EMR of another hospital: 45 percent of the end users were very dissatisfied with the outcome of the integration of RIS with EMR of main hospital with associated hospital and vice-versa. Another 25 percent of the respondents were dissatisfied with the outcome of such an integration.

Smart Card – Synchronization with RIS data: 75 percent of the end users were very much dissatisfied with the lack of synchronisation of smart card with the RIS.

Data Transmission – Rate of transmission between two hospitals: 15 percent of the end users were satisfied with the data transmission rates between main hospital and associated hospital. Another 5 percent were dissatisfied with the rate of data transmission between the two hospitals.

The following were the responses to data transmission aspect:

Availability of Data transmission: 15 percent of the end users were satisfied with uptime of the data availability between both the hospitals.

IT support in case of failure of data transmission: 55 percent of the end users were dissatisfied with the support provided by Department of Information Technology in the case of failure of the data transmission. Another 10 percent of the respondents were very dissatisfied with the IT support in case of failure of the data transmission.

Following were the responses to Web Interface aspect:

Availability: 60 percent of the end users were very dissatisfied with the lack of availability of Web Interface in both the hospitals. Another 20 percent of the respondents were dissatisfied with the lack of availability of web interface for online data exchange.

Delivery of Results: 65 percent of the end users were very dissatisfied with the web interface for providing delivery of the results of various investigations undertaken.

The advantages felt by the user's:

Saves time: Most of the end users (60 percent) replied in affirmative that the RIS/HMIS and PACS saves lot of time. Another 35 percent were very satisfied with the advantage of saving time.

Saves Cost: 65 percent of the end users agreed that RIS/HMIS and PACS brings cost cutting via decreasing the need of films and paper etc.

Increases Productivity: 65 percent of the end users agreed that RIS/HMIS and PACS increases productivity. Another 35 percent of the respondents were very bullish about this fact.

Storage: 60 percent of the end users replied in affirmative that storage of the data becomes easy and requires lesser space. Another 40 percent of the respondents were very satisfied with the fact that storage becomes easy as lesser number of films and paper records had to be maintained.

Decrease HR: 35 percent of the end users responded that requirement for human resources had reduced after the implementation of HMIS/RIS and PACS. Another 25 percent very strongly agreed to this fact.

Scheduling: Most of the end users agreed to the fact that HMIS/RIS help in scheduling.

Analysis: 45 percent of the end users agreed that RIS/HMIS helped in analysis of the data. Another 25 percent strongly agreed to this fact.

Resource allocation & budgeting: 50 percent of the end users agreed that RIS/HMIS helped in resource allocation and budgeting exercise. Another 15 percent of the respondents strongly agreed to this fact.

Billing/Account Receivable: 35 percent of the end users agreed that RIS/HMIS helped in billing and managing accounts receivables with 15 percent vouching strongly in its favour.

Patient Tracking: 55 percent of the end users agreed that RIS/HMIS helps in tracking the patients with additional 15 percent agreeing very strongly.

Modality & Material Management: 50 percent of the end users agreed that RIS/HMIS and PACS helps in modality and material management. Another 10 percent of the respondents agreed strongly to this fact.

Alerts: 45 percent of the end users agreed that RIS/HMIS and PACS alerts help in better patient

management. In addition, 10 percent of the respondents agreed very strongly to this advantage of HMIS/RIS and PACS.

Comparison of overall performance of RIS:

Overall performance of RIS at main hospital: Overall performance of RIS at main hospital was rated as Satisfactory by 55 percent, neutral by 35 percent and very satisfactory by another 10 percent of the respondents.

Overall performance of RIS at associated hospital: Overall performance of RIS at associated hospital was rated as Dissatisfactory by 25 percent, neutral by 70 percent and satisfactory by rest i.e., 5 percent.

Responses to miscellaneous aspects:

Patients' Compliance:

As far as the patients compliance to paperless and filmless milieu via HMIS/RIS and PACS is concerned, 35 percent of the end users were strongly dissatisfied, another 35 percent were dissatisfied and only 10 percent were satisfied with the patient compliance to filmless and paperless milieu.

Amendments: As far as amendments to the existing software programs were concerned, 50 percent of the end users were very dissatisfied with the existing scheme of things to update anything as it required a lengthy procedure and lot many permissions from higher authorities.

Cross-Referrals: 45 percent of the end users were very dissatisfied,another 20 percent of them were dissatisfied with the existing cross-referral functionality built within the RIS/HMIS and PACS.

Training: 60 percent of the end users were very dissatisfied with the training facilities for the staffin both the hospitals.

Discussion

It is essential to integrate HIS/RIS to PACS so that it combines patient's data with the respective image and the entire set of data with image makes considerable sense to the end user collectively.[10] There have been cases in the hospitals where the PACS server was down and the clinicians were not able to review any images until the server was retrieved. It led to enormous trouble to the patients and the doctors themselves.[11] Few studies report the downtime issues which were not substantiated by a very authentic and satisfactory recovery solutions.[12]

Many of the respondents were not satisfied (60%) with the kind of legal guidelines available regarding the use of RIS/HMIS. The matter of the fact was that the legal protocol was not made available to the staff and they were not oriented to these aspects as well.

Redundancy refers to the backing up or copying data on additional servers or by other electronic means as a security measure. Most of the respondents (45 percent) were not aware of the kind of redundancy available with RIS in the hospitals.

Image quality is very important aspect of the PACS. 65 percent of the end users were satisfied with the quality of the images made available via the PACS and 20 percent were very satisfied. Thus, the overall quality of images was good.Ease of use of any HMIS/RIS is very important. Around 60 percent of the end users were very happy with the user interface provided via HMIS/ RIS at both the hospitals.

Cine-mode and scroll through a series of images helps a lot in appreciation of images and arriving at the correct findings. 30 percent of the end users were satisfied with such functionality of the RIS/PACS.

Synchronisation of two images aids in radiology diagnosis. Only 25 percent of the end users were satisfied with the available facilities. Synchronisation of different examinations is also important. 30 percent of the end users were dissatisfied with the synchronisation facility available through RIS/PACS.

30 percent of the end users were satisfied with the location of the reading room in radiology department. Overall performance of RIS at main hospital was rated as Satisfactory by 55 percent, neutral by 35 percent and very satisfactory by another 10 percent of the respondents.

Overall performance of RIS at associated hospital was rated as Dissatisfactory by 25 percent, neutral by 70 percent and satisfactory by rest i.e., 5 percent.

Training of the staff is very essential component to make use of any Information Technology product. As far as training in HMIS/RIS and PACS is concerned, both the hospitals were found lacking in this crucial aspect. Around 60 percent of the end users were very dissatisfied with the training facilities for the staff.

Various studies also stated that user acceptance is an essential tool before implementing PACS as it greatly determines the success rate and also stated the importance of training or familiarization programs should be given utmost importance in order to motivate the employees ultimately increasing the productivity of the system.9

Conflict of Interest: Nil

Source (s) of Support: Nil

Ethical Clearance: The study was conducted as a dissertation for Master in Hospital Administration after administrative approval.

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