

**RADIOLOGICAL INFORMATION SYSTEM: A NOVEL STUDY****RAHUL P KOTIAN\*<sup>1</sup>, NACHIKET GUDI<sup>2</sup> AND BATULLA TEJASWARA REDDY<sup>3</sup>**<sup>1</sup>*Department of Medical Imaging Technology, School of Allied Health Sciences, Manipal University, Manipal.*<sup>2,3</sup>*Department of Health Information Administration, School of Allied Health Sciences, Manipal University, Manipal.***ABSTRACT**

Background: Health is the fundamental right of every individual. Health care comprises of all the services provided to maintain the health of a person. Health care documentation also plays a vital role in assisting the providers to offer better care. Challenges faced in the management of electronic data in the health care industry are; capturing and sharing of patient data; especially the digital images have been an emerging challenge to the healthcare sector, language difference between HL7 and DICOM, the major problems faced by the use of broker software are; firstly its unidirectional workflow design and secondly paper based, leading to the duplication of data. Objective: The objectives of this study are to provide an understanding about RIS, information about the challenges faced by the healthcare industry during the introduction of the RIS, and establishing a comparison between the trends in the Western world and Asian countries. Methodology: Following the search a review of the related articles was carried out based on the content obtained. The review is a narrative literature review with focus on current trends, outcomes of integration of RIS to HIS and its advantage for all the stakeholders. Results: Based on the obtained articles the current trends were analysed with major emphasis laid on the outcomes of the integration of the RIS to the HIS and its effect on the overall hospital, patient and other stake holders benefits. Conclusion: The solutions to the challenges faced by the healthcare industry in the management of digital data is evident from the study, yet the question that provides scope for further study is the huge finance that is involved , its effective management and strategies to implement the integration on a large scale in developing countries.

**KEY WORDS:** Module, Radiology, Information system**RAHUL P KOTIAN**

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## INTRODUCTION

Physical and mental health and wellbeing is not only the fundamental right of every individual, but also the need of the hour. Capturing and sharing of the patient data, especially the digital images have been an emerging challenge to the healthcare sector. RIS abbreviated as a Radiological Information System is often regarded as the epicentre for the electronic management of the medical imaging department. The prime functions of the RIS include patient scheduling, resource management, examination performance tracking, interpretation, dissemination of results and billing.<sup>1</sup> RIS also acts as a centre in which radiologists can schedule patient appointments and track patient records and observe his condition throughout his treatment period till he is discharged. PACS abbreviated as Picture Archiving and Communication System is a health care technology for the short and long-term storage, retrieval, management, distribution, and presentation of medical images. It allows a health care system in capturing, storing, and sharing of medical images inside the health care system and between different ones.<sup>2</sup> DICOM which is abbreviated as Digital Imaging and Communication in Medicine, helps in the paperless communication of high resolution medical images. It acts as a link between various radiological systems and equipment. DICOM enables the connectivity and communication between various modalities using different workstations. RIS

which is a subcomponent of Hospital Information System has a vital role in adding, retrieving and transmitting medical images in a health care network.<sup>3</sup> IHE which is abbreviated as the integrating healthcare enterprise provides the framework by which existing standards are to be used. With the development of IHE and Telemedicine, which paved the way for the development of teleradiology, which is the sharing of medical images between different healthcare organizations for the purpose of study and referential diagnosis.<sup>4</sup> The common problem faced during the introduction of radiological system was a language difference between HL7 and DICOM. This problem was solved by the introduction of the broker software which converts the images received from HL-7 into DICOM format for transmission into PACS. The broker which is a hardware and a software device supports this function by considering the DICOM modality worklist.<sup>5</sup> The major problems faced by the healthcare professionals at the early stage were I) Unidirectional workflow design II) Paper based, leading to the duplication of data. In order to overcome this complication the Integrating the Health Care Enterprise (IHE) initiative was developed, the goal of which is to provide the end users the improved access to clinical information across all systems within the healthcare delivery network. The components of the integrated health enterprise include PACS, RIS and DICOM.<sup>6</sup>

**Figure 1**  
**Workflow of RIS**



The workflow of RIS starts when the patient registers himself for the diagnostic procedures. Firstly, the patient details are entered into the system. Secondly, the patient is taken for the procedure and the captured data is stored in PACS; which is a storage area from which the image can be accessed as and when the need arises. Each image is tagged with a unique hospital number. Whenever physician requires the image he enters the tag and hence the image is retrieved.

## METHODOLOGY

Using PubMed and Google Scholar as database search engines, the terms "RIS, HIS, PACS and DICOM" were used with different combinations and a narrative

literature review was conducted to determine the flow of radiology information system and the end user benefits by focussing on "Research on development of radiological information system and DICOM standards between 2000 – 2016".

### INCLUSION CRITERIA

Studies on "Research on development of radiological information system and DICOM standards" between 2000– 2016.

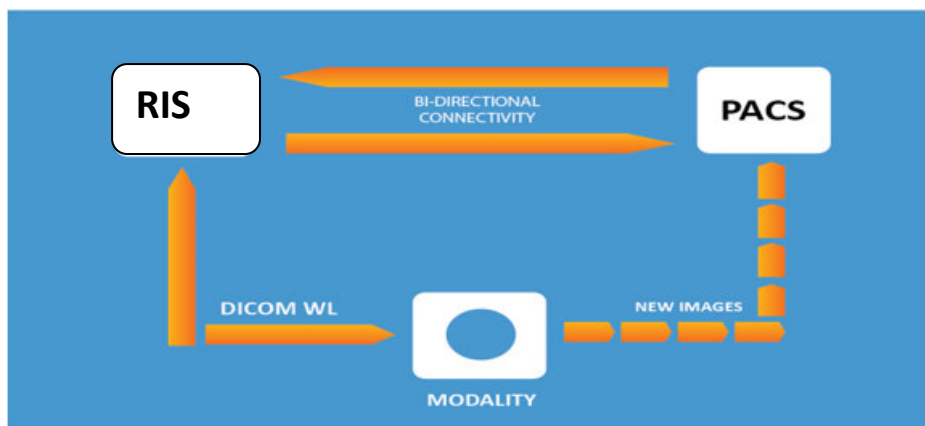
## RESULTS

### SOFTWARE ADVANTAGE

The integration of the health information system and the radiological information system has revolutionised the method of image viewing, analysing, storing, sending

and retrieving. Storage area for the entire imaged data is reduced to a small chip or even cloud storage, which can be used with a supportive software (PACS). On introduction of the Integrated Health Care Enterprise the communication pattern became bidirectional.

**Figure 2**  
**Bidirectional Communication**



### END USER BENEFITS

For the physicians who form the integral part of the health care system makes it to diagnose complex diseases with the use of high resolution images. For radiographers and technologists there will be easy access to the digital images of the patient. RIS also helps the radiographers in diagnosing the patient condition. Integrated RIS allows sharing of digital images between two different health care facilities which not only saves resource in terms of time and money but also reduces the patient's exposure to radiation by waving off repeated tests and screening activities. For the hospital RIS helps by improving the laborious procedures of scheduling orders which has its direct effect on the time. The cost of discarding the radiological films after its use and lapsing of storage time is also reduced thus reducing the entire space as well as the cost of printing and destroying the films. The integration of the health information system and the radiological information system has revolutionised the method of image viewing, analysing, storing, sending and retrieving..

## DISCUSSION

RIS is the core component of HIS, responsible for image management. Thus integration of RIS and HIS forms the basis to attain the gold standard. Basic requirements for PACS and RIS are similar across imaging practices. This allows the practice to receive physician orders safely, and efficiently performing the medical imaging procedure following the sending of image and results to the physician and then to the patient. The 3D image storage and viewing advancement has given the physicians the access to explore minute areas of the human body. This technology is mainly used to detect any minute abnormality in the human body. The development of

speech recognition software has improved the radiological documentation process. Introduction of RIS helps the technologist to process the image quickly and to facilitate swift downstream availability of the data.<sup>7</sup> The challenges faced in the Asian countries regarding the integration of RIS and HIS is that the hospitals don't opt for a complete package from a single vendor. They try to buy packages without anticipating the maintenance costs. Once the HIS is installed the practitioners are not given sufficient hands on training to become well versed with the newly implemented system. Organisations also face many technical problems such as network issues, storage space (if they haven't opted for the cloud storage), policy issues when the data is to be shared across the countries between the healthcare providers when the patient is referred for other healthcare facility. Ensuring proper security measures is again proved to be a costly affair as far as Asian subcontinent hospitals are considered.<sup>8</sup> Having qualified professionals who are good at handling electronic data storage can help to ensure the security of the data thereby protecting the privacy of the patient's information. On the other hand a huge cost is incurred in appointing qualified professionals and most of the hospitals often look for quick return on investment. They appoint people with less credentials thereby comprising the quality of patient care.<sup>9</sup> There is an improved scenario when the situation in the western world (United States of America and the Latin America) is considered. The western world spends almost 10% of its GDP (Gross Domestic Product) on healthcare which quite more than that spent by the Asian countries.<sup>10</sup> Hence the cost of maintenance and ensuring the patient safety is not a matter of concern. The challenges faced by the hospitals in the West are excessive hacking attempts on patient data. They have a thorough understanding of the importance of patient data and the quality of data capture and storage.

## CONCLUSION

The study was conducted in order to find out; what are the major barriers regarding the capture and storage of digital data as well as the challenges of continued usage of paper based records in the healthcare industry. There is a great need for the healthcare industry to revolutionize the way of handling and exchange of patient data. This can be achieved through training and continual education of the professionals handling the patient data. Hence the study conducted results down to show the solutions applied to the direction of data flow and the advantages of integration and implementation of a complete HIS on the patient's digital data as well as the way it catalyzes in making the diagnosis. Yet the question that provides scope for further study is the huge finance that is involved, its effective management and strategies to implement the integration on a large scale, in the developing countries.

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in this article.

## ABBREVIATIONS

HIS-Hospital Information System, RIS-Radiological Information System, DICOM-Digital imaging communication in medicine, PACS-Picture archiving and communication system.

- Healthcare Enterprise (IHE) initiative. *J Digit Imaging* [Internet]. 2000 May [cited 2016 Mar 20];13(2 Suppl 1):180–2. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3453251&tool=pmcentrez&rendertype=abstract>
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