Research Article

Assessing the performance of the radiology information systems in use in the teaching hospitals of Isfahan city based on the Great Britain's royal college of radiologists' guidelines

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ABSTRACT

Background: Radiology Information System (RIS) coordinates the organizational processes and administrative based on information. The present study was an attempt towards a performance assessment of the RISs used in general Isfahan hospitals.

Methods: This study was descriptive cross-sectional in nature. Its statistical population consisted of the general teaching hospitals of Isfahan city (Iran). Due to the limitedness of the population of study, the sample size was the same as the population size. The data were collected using a self-designed checklist produced based on the royal college of radiologists' guidelines, i.e. input components (13 items), process components (10 items) and output components (8 items). The researcher collected the data through observation and interview. The validity of the checklist was assessed by the health information system field's valid authorities. Finally, the gathered data were put into SPSS 16 software and analyzed using descriptive statistics.

Results: Among the RIS in the hospitals, Kashani, Isa Ibn Maryam and Nour & Ali Asghar had the highest rank for input components (mean score = 30.79%). As for process components, Al-zahra, Kashani and Isa Ibn Maryam gained the highest position (mean score = 38.9%). Finally, Al-zahra and Kashani hospitals with a mean score of 66.66% enjoyed the highest rank for output components.

Conclusion: RIS must be capable of satisfying a number of requirements including satisfying the medical needs of the patients, producing the reports, image and report processing, patients' appointment scheduling, the procedures for receiving and administrating the orders and other radiology procedures.

Keywords: Radiology information system, Assessment, Great Britain's royal college of radiologists

INTRODUCTION

With the advent of digital medical equipments and the very tendency newly emerged in the medical sciences field towards software movement as well as the necessity of hospitals working towards integrating the health and medical information of the national hospitals, paraclinical departments especially medical imaging departments have taken effective steps towards using information technology to assist with the diagnosis procedures by the

radiologists and the treatment procedures by the physicians.[1,2] One of the most frequently used technologies is the hospital information system, radiology information system one of its sub-systems,[3] which plays a significant role in promoting the quality of health services, enhancing the level of satisfaction of the beneficiaries, improving the medical economics and finally producing competitive advantage in the modern changing context.[4] According to World Health Organization (WHO), nearly as much as 30% of the medical cases worldwide require diagnostic imaging for achieving a proper diagnosis.[5] Hence, radiography requesting is an integral part of the medical profiles of most patients. Producing these data along with the respective images in an electronic format is of particular significance.[6] RIS allows managing the maintenance and distribution of the films and their associated reports.[7] In one study conducted in USA, the effect of RIS on lowering the hospital costs was explored. The findings revealed that implementing RIS in the hospital was followed by a 26-30% decrease in the hospital costs.[4] In addition, this system brought drastic changes in the workflow in the radiology department so that a reduction of 21-80% and 25-30% were observed in the workflow and imaging procedure in the radiology department, respectively.[8] According to the findings of another study conducted in New Zealand, when using this system, the user can simultaneously record and display the information enabling the continuous storage of the resulting data.[9] The role of radiology images in promoting the qualitative and quantitative level of society health in terms of diagnostic, medical, education and research fields as well as their profitability and economic benefits are of particular importance for the medical centers. Items such as health information system's infrastructures, the quality of radiology images, the way of storing and retrieving the images, the time required for completing the imaging procedure, the tools used for reviewing the radiology images, processing and interpreting the images' data and producing the radiology reports, the marginal costs of imaging services, the capability of sending the images for the users, the capability of reviewing the images for different purposes, the method of reporting and the managerial procedures all are among the requisites of creating a dynamic and successful RIS.[4] Accordingly, since it is possible to prevent irreversible errors by assessing the system and improving its quality using its resulting feedbacks for identifying the strengths and weaknesses of the system,[10] the present study was conducted with the aim of assessing the performance of RISs in use in the teaching hospitals situated in the city of Isfahan.

METHODS

This descriptive cross-sectional study was conducted in 2012 based on a selected statistical population of general teaching hospitals situated in the city of Isfahan. Due to the limitedness of the population, the sample size equaled the population size. From six hospitals in question, Farabi hospital was excluded from the population since it had no hospital information system. Data collection instrument was a self-developed checklist developed based on royal college of radiologists' guidelines. It was organized based on three main category of components i.e. input (13 components), process (10 components) and output (8 components) filled out by the researcher following two methods of direct observation and interview. The validity of the checklist was confirmed by reference to the evaluations made by the respective professionals engaged in the health information system domain. Then, the collected data were put into SPSS16 software and analyzed using descriptive statistics.

RESULTS

The results obtained on the performance of four RISs i.e. Kowsar (New version), Kowsar (Old version), Sayan Rayan Ekbatan e Hamedan and Puoya Samaneh revealed that the highest mean scores. For meeting the input components in the RIS belonged to Kashani, Isa Ibn Maryam, Noor & Ali Asqar hospitals (an average score of 40.79%). As for process components, the highest mean scores were found to be for Al-Zahra, Kashani and Isa Ibn Maryam hospitals (an average score of 38.9%). As far as output components were concerned, Alzahra and Kashani hospitals possessed the highest mean scores i.e. 66.66% (Table 1).

Table 1: Examining the level of conformity of the RIS's components in use in the hospitals under research with the royal college of radiologists' guidelines.

The name of the hospital / Mean score	The type of RIS	Input components (%)	Process components (%)	Output components (%)
Al-Zahra	Kowsar (New version)	23.07	38.09	66.66
Kashani	Kowsar(Old version)	30.79	38.09	66.66
Isa Ibn Maryam	Sayan Rayan Ekbatan	30.79	38.09	55.55
Nour & Ali Asqar	Sayan Rayan Ekbatan	30.79	33.33	55.55
Amin	Pouya Samaneh Diva	23.07	38.09	44.44
Total		27.69	37.14	57.77

The assessment of the input, process and output components indicated that for the inputs, the record of patient consent or dissent to share his/her related data, the record of paper-based requests and their processing like electronic requests, the record of general data in relation to the method used for imaging, the record of imaging details (the dose of the used medication, the technique used and other related items), the record of the used contrast agent and other prescribed medications and the use of voice recognition software stipulated in the royal college of radiologists' guidelines were among the items which have not been satisfied.

As for process components, the cases of unconformity of the RIS with the royal college of radiologists' guidelines were as follows: organizing the booking, scheduling the imaging procedures, prioritizing based on the anatomical location to be imaged, the time and date of searching for the Rontgen film pockets (X-ray film), digital images and hard copy archives.

As for output components, the items stipulated in the guidelines but not observed in the RIS included pre-procedure related information record (e.g. the Radioisotope injection), records on the quality of imaging and the possibility of printing the pre-determined appointment papers given to the patients. In Table 2, you can find a summary of the other components observed in the RISs in the hospitals in question as per the guidelines.

Table 2: The level of the conformity of the input, process and output components in the RISs available in the hospitals under research based on the royal college of radiologists' guidelines.

Input components	%	Process components	%	Output components	%
The permission to access the system by the authorized user or using a valid password	100	The provision of processing the electronic requests through integration with the "Electronic Remote Requesting" (ERR) system	20	The provision of the possibility of text data mining so as to search a word or phrase in the patient's electronic profile	20
The record of identity related data and the functions of the persons involved in the imaging services	100	Up-to-dating the patients' demographic information automatically using the patient's master patient index	100	Creating sophisticated billing mechanism	100
The capability of receiving electronic requests through integration with "Electronic Remote Requesting" (ERR) system	40	Observing the integrity and coordination in the appointment booking assigned to the patient using the hospital information scheduling system	20	The continuous audit of the patient's information and their modifications	100
Allowing the addition of new imaging information to the old information	40	Easy access to the work list of the radiologists	100	Discrimination of completed actions from uncompleted actions	100
		The provision of the capability of confirming the reports by the user	100	Alarming against the words' wrong dictation and incorrect word-processing	20
		Assigning predefined codes for facilitating the audit, education and management activities	100		

DISCUSSION

Exercise of conformity of the RISs in question with the royal college of the radiologists' guidelines belonged to the output components obtaining a mean score of 57.77% while the process and input components occupied the next ranks (having a mean score of 37.14% vs. 27.69%. The extent of observing the reference criteria in the RISs indicated 54.9% for input components, as much as 55.2% for process components and finally, as much as 37.7% for output components.[4] Among the inputs components, the highest conformity of the RISs belonged to the password options, the record of administrative data related to the patient, physician and other persons involved in the imaging process. The highest conformity for the process components of the RIS was related to the integration of the system with the Patient's Index, the user-friendly system, the confirmation of the reports, facilitating the activities through assigning pre-defined codes, differentiation of incomplete informational components, billing and auditing trail of the users' access to the patients' information and the changes made to them. The

highest level of conformity of the RIS's output components was reported to be for reporting options to support imaging workflow, meetings, education, audit and research, system speed, issuing and distributing the reports and the capability of displaying the new patient's data added to his/her old data.

Pare et al. (2005) in their study conducted in the Montreal University of Canada found that physicians and radiologists regard the applications of information technology in the health domain as an efficient knowledge and instrument useful for conducting medical diagnostic procedures and they fully trust the precision and correctness of their services.[11] In this study, the highest levels of conformity of RIS's input components were gained for Kashani, Nour & Ali Asqar and Isa Ibn Maryam hospitals with the lowest conformity belonging to the Al-zahra and Amin hospitals. The highest and lowest levels of the conformity of RIS's process components were found to be for Al-zahra, Kashani, Isa Ibn Maryam and Amin hospitals and Nour & Ali Asqar hospitals, respectively.

In addition, Al-zahra and Kashani hospitals gained the highest positions in meeting the input components in their used RIS while Amin hospital gained the lowest position. On the whole, according to the results of the assessment of the input, process and output components in all hospitals in question were lower than 60% signifying the inappropriate condition of the system in these areas. In particular, as for input and process components whose levels of conformity were found to be below 40%, it is necessary to enhance the level of conformity of these systems with the standards of RIS in their future development paying more attention to the royal college of radiologists' guidelines. Based on a research the best way to preserve the user's satisfaction with the hospital information system is when designing this system, rather than the viewpoints and requirements of the system's developers, the viewpoints and requirements of the system's users must be taken into account.[6,12] In another study conducted in the Germany association for medical informatics, Munch et al. (2003) argued that an integrated information system enables the users to easily carry out the working procedures operations without any need to make changes in the various applicable programs and software. Furthermore, exploiting the integrated teleconference system considered as a sub-system of the foregoing system would result in a remarkable improvement in the medical treatments and health care quality by providing an appropriate context for idea exchange and telephone-consultation with the medical sciences' professionals.[13]

Honeymoon (1999) believed the provision of rapid access to the patients' data will help the physicians to carry out the diagnosis and treatment procedures more rapidly and accurately using the patient's complete information.[14] In another study in USA, Loux et al. showed that launching an integrated imaging system may allow the urban and rural hospitals connection enabling data sharing between the radiology department and other departments and organizations. In this way, they will significantly decrease the expenditures. Furthermore, rural hospitals' radiologists held that using this system, they succeeded to perform their functions more easily and rapidly than the past.[15] It is noteworthy that these are the very components which little consideration has been given to them in the RISs in use in the hospitals under research. Given the fact that any system introduced in any organization for the first time will encounter a lot of problems on the one hand[6] and given the enormous costs required for its commissioning and implementation,[16] a continuous evaluation must be done on several factors including radiology information system, the quality of radiology images, the way of storing and retrieving the images, the time required for doing the procedures, the available instruments for studying the radiology images, processing the information contained in the image and their interpretation, producing radiology reports, the marginal costs of imaging services, the capability of sending the images for the users, the capability of reviewing the images for different purposes, the method of reporting and finally the managerial processes all of which are among the vital prerequisites for creating a dynamic and successful RIS.

The provision of a coherent and standard information system allowing the satisfaction of the medical needs of the patients, reporting, images and reports processing, scheduling the patients' appointments, the procedures of receiving and implementing the orders and other activities and processes of the radiology department based on the most advanced technology of the world is an inevitable necessity. This, in turn, increasingly illuminates the need to evaluate the available systems and present modification strategies appropriate for them.

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