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EXPLAINING THE UNDERSTANDING OF MEDICAL CENTERS STAFF OF THE CAPACITY OF RADIOLOGY INFORMATION-SYSTEM (RIS): A QUALITATIVE STUDY

Mehdi Kahouei¹, Mohsen Soliamani^{2*}, Elham Hasheminezhad³

¹ Social Determinant of Health Research Center, Nursing and Allied Health Faculty, Semnan University of Medical Sciences, Semnan, IRAN

² Nursing Care Research Center, Nursing and Allied Health Faculty, Semnan University of Medical Sciences, Semnan, IRAN

³ Student research committee, Nursing and Allied Health Faculty, Semnan University of Medical Sciences, Semnan, IRAN



ABSTRACT

Introduction: Radiology Information System impacts on improving the performance of doctors and other radiology personnel and more importantly improving treatment-management status of patients through better management of radiology information. It seems that evaluating the effectiveness of the system is important from the perspective of radiology employees. **Methods:** In this qualitative study, data were collected through semi-structured and in-depth interviews and analyzed by content analysis and constant comparison method. Participants were 12 employees of radiology departments of affiliated hospitals of Semnan University of Medical Sciences, Iran. Purposeful sampling method was used and continued until data saturation. **Results:** The two themes that emerged from the interviews were divided into data recovery capacity and system capacity in information input and output. The themes were included access to patient's previous information, search features in the system, providing the desired output and input data. **Conclusion:** This study showed that hospital staff of training hospitals of Semnan has limitedly understood the capabilities of Radiology Information System. This was because of the limited capacity of this information system in information retrieval, image archiving, and limited data entry methods that had led the employees not to well understand the benefits of this information system.

INTRODUCTION

KEY WORDS

Explaining, Capacity, Radiology Information-System

Radiology Information Systems (RIS) is one of the sub-systems of hospital information system (HIS) formed for sharing information, contributing to the effectiveness of clinical processes and reducing errors [1,2]. It is now more than seven years that Semnan University of Medical Sciences has launched RIS in the radiology wards of the subsidiary hospitals. During the initial examination of this system, issues such as demographic, insurance, financial, and administrative information of the patients with information about the x-ray type done for clients is recorded on the computer- all the parts of this system are not yet fully active yet. Considering that a systematic evaluation of the efficacy of this information system is not available, it seems that investigating the views of the users and beneficiaries of this system about the efficiency and functionality of it can provide valuable information about the evaluation of this system. In addition, what meaning the efficiency of RIS has from the perspective of the staff and has this system been able to provide the appropriate functionality.

Given the importance of RIS in improving the performance of doctors and other radiology personnel and more importantly improving treatment-management status of patients through better management of radiology information, and understanding users' expectations of an information system are critical in its evaluation, it seems that evaluating the effectiveness of the system is important from the perspective of radiology employees.

This is so because in Iran, no studies have been conducted on the effectiveness of this information system. RIS in the form of HIS runs in most hospitals affiliated to Semnan University of Medical Sciences, and this information system can have multiple segments. However, considering the social, economic, and cultural contexts in Iran, perhaps enabling all relevant facilities related to RIS is not possible in Semnan University of Medical Sciences. Thus, in this respect, numerous questions are raised to the researchers, such as whether this information system is efficient from the perspective of personnel. Moreover, in what fields has RIS been efficient?

MATERIALS AND METHOD

This study has used the conventional content analysis method. Conventional content analysis is an appropriate method for obtaining valid and reliable results from textual data to create knowledge, new insights, report facts and suggest ways for practical solutions [3]. Some of the questions that this qualitative method can answer include: what the users know about the efficiency of the radiology information system and what is their view about it, the current complexities with regard to the system and what kind of effects to expect from it, which function of the information system could be more important for the users and what factors affect the efficiency of the radiology information system. Accordingly, the present study is a qualitative one because it addresses the issue of the nature and effect of information systems and inquires about the efficiency and different aspects of information systems.

*Corresponding Author

Email:
Soli257@yahoo.com
Tel: + 98 (231) 33654190
Fax: +98 (231) 33654161

Received: 12 Sept 2016
Accepted: 2 Oct 2016
Published: 5 Oct 2016

The case studies include the radiology departments in affiliated hospitals of Semnan University of medical sciences. The research sample included the administrations and personnel of the radiology department, physicians, nursing staffs and medical students. Therefore, the users who were willing to cooperate and share their experiences with regard to the radiology information systems were interviewed.

The inclusion criteria were the willingness of the participants and having at least three months of work experience. The participants were chosen by purposeful sampling from the people who had the sufficient experience about the topic and willingness to participate in the study. In light of the principle of maximum variation in sampling, the participants were chosen from the users with different age and work experience. The personal information of the participants, including, age, gender, education and experience was recorded. Sampling continued until data and category saturation [4].

12 people participated in this study. Having obtained the approval and written consent of the participants, the sample people were interviewed individually in a detailed manner. A structured interview, field notes and manuscripts were used for data collection. The core question in the interview concerned the efficiency of the radiology information system. The interviews began with an open question, namely, "What is your definition of the radiology information system?" The follow-up questions were asked based on the responses of the participants to further investigate the topic, including: what uses does the radiology information system have for you in a single shift? How helpful is the system in carrying out your duties? Is the system in your ward efficient enough? Why or why not? What criteria do you have for the efficiency or inefficiency of the system? What could increase the efficiency of the system in your ward? What are some of the advantages of using the system? Some exploratory questions such as, "Could you explain more?" or "Please, make an example" were used to encourage the participants and get more accurate data. Each interview lasted between 30 to 45 minutes. The interviews were done in the radiology departments of the hospitals. The interview conditions, such as location, temperature, light and air conditioning were appropriate. The data collection and analysis were done simultaneously. The data analysis was done by using the conventional content analysis method and was based on the responses of the personnel.

The Lincoln and Guba criteria were used to determine the rigor of the data. Prolonged engagement of the researchers, sufficient participation, appropriate interaction with the participants, integration of the data and member check increased the credibility of the data [5]. On time transcription, external check and rereading the whole data ensured the dependability of the data. Time triangulation and sample variety increased the credibility and conformability of the data. The determining-confirming of the data was proven by the impartiality of the researchers and agreement on the codes and themes. Transferability and fittingness were observed by including direct quotations and examples and the consultation of experts in the field [6].

Ethical considerations

For this study, the approval of the committee of ethics of Semnan University of Medical Sciences was obtained. The permission of the administrative was obtained prior to the start of the study. The participants were informed about the aim of the study and the way to answer to the questions. The confidentiality of the data and the right to exit from the study were explained to the participants. Also, a written consent was received from the participants for voice recording and interview.

RESULTS

Table 1 shows the participants' demographic characteristics.

Table 1: Subjects study's demographic characteristics

Characteristics	Groups	N	%
job	Radiologist	1	8
	Nurse	1	8
	Worker	8	66
	Student	2	18
Sex	Male	8	66
	Female	4	34
Education	Technician	5	42
	Bachelor degree	3	25
	Master degree	1	8
	Doctor	3	25
Job experience (Year)	< 10	6	48
	10-14	4	34
	15=<	2	18

After determination of the basic concepts, 29 initial codes were extracted from the interviews. These codes were summarized after reviewing and classified based on similarities and fit, and after further reviews and comparing classes, their internal meanings were identified as primary themes. The primary themes were given names according to their nature conceptually and in an abstract form. Themes and their formation process are shown in Table 2 and approved by the statements of participants.

Table 2: Codes, Classifications and Themes

Codes	Classifications	Themes
Maintenance and filing	Access to Patient's Pervious Data	The capacity of information retrieval
Data Archive		
Storage of Data		
Access to Pictures		
Limitation of Maintenance Capacity	Possibility of Researching in System	
Data Research		
Research Possibility		
Easy of Research	Providing the desired output	The capacity of system in inputting and outputting of data
Errors Report		
Practices Report		
Incomes Report		
Data Obtain Duration	Inputted Data	
Statistics		
Practice Assessment		
Record of Patient's Identifications		
Data Input		
The possibility of Data Input		
The accuracy in data entering		
Mistake in Data Input		
Unavailability of patient's Picture		
Time –consuming in data entering		
Data entering is time-consuming		
Possible of fast data entry		
Data entering via online		
Manually and Automatically Entering of Data		
Possibility of Data Editing		
Inability to Edit the Recorded Data		
Completely Entering of Data		
Awareness of Patient's History		

A: Data recovery capacity

Access to patient's previous information

Participants expressed that RIS should be such that patient records, information, characteristics of patients, hospitalization history, and other demographic data can easily be determined and used. Participants believed RIS should have the ability to archive patient information, so that it can be used at whenever necessary. Based on their responsibility, the staff should be able to have access to radiology images of the patient whenever needed, and if they have additional information about previous diseases and disease history, they should be able to view them without any problems. The following two quotes exist in line with this concept.

"All information is stored in a server. Images of years are saved, and it is a very good archive." "Another advantage of this system is that you can go and see the image of your patient even when he is not in the hospital because it keeps and saves it and has a memory. You can see the image of everyone who has come to the hospital from the first day."

Search features in the system

They believed that RIS should have good search facilities, so that they can easily see patient's radiology images based on the characteristics of the patient. Alternatively, if they are supposed to look for a particular word, they could easily receive supplemental features by searching through entering a word, so that they register the intended word as soon as possible. The following is examples of statements of the

participants. "The great help that the system has is that I can search the information I get from the patients in other parts and can review the patients' file. If it is not used properly, it may cause trouble. If I enter patient data wrongly, the images can be wrong. If I enter the patient's name wrongly, you cannot find the patient no matter how much you search. Another issue is searching. Sometimes if you do not have the patient's code, you can hardly find him."

B: system capacity in information input and output

Providing the desired output

Participants believed that RIS should have appropriate capacity in data entry and providing output. In other words, patient's information and records should enter the system easily and without spending a lot of time and with enough precision. Systems should have the ability to connect to other systems and receive information from them. One of the participants stated, "With this system, deduction, personnel errors, everything is recorded and is available. I can get daily information of exposes, income, and all the information monthly or daily." Another participant stated, "With this system, the number of exposes, number of images, the exact number of patients, and patients' records all are recorded."

Input data

Participants believed that entering patient's data to RIS is time-consuming currently, and because of problems in some cases, some problems are created in the image search that cause delay in following patient's problems. Two following two quotes are in line with this concept. "Sometimes, the patient's image in the system is not available- either the name of the patient or admit code is entered wrongly. I do not know what has happened, but sometimes, the patient's image is not in the PACS (picture archiving and communication system), and this is a problem." "Working with it is a little bit harder because we must enter everything, father's name, date of birth, National ID, and it takes a bit of time."

DISCUSSION

The results of this study showed that one of the key components of the efficiency of RIS is high capacity of data recovery by the system. RIS should provide the possibility of access to patient's previous information and provide adequate facilities to search information in the system. In their study about information systems in the radiology department, Nani et al. state that in clinical and organizational terms, the primary goal of RIS, before anything else, is to improve service delivery. In radiology department, planning for evaluation or archiving images are two important issues that HIS can help [7].

In archiving images, it is essential that the information be properly archived and retrieved when needed. In their study on the structure of the RIS, Pereira et al. stated the system's ability to store and retrieve information an essential part of the system [8]. This information includes demographic data, information created by experts, and information generated by the system itself.

Demographic data of the patients is obtained through the connection of this system with HIS, which shows the importance of the relationship between this system and its integration with other hospital information systems. Clinical information includes information that is created by an expert and used for diagnosis. Some information is also caused by the system itself that is the result of the analysis, processing, and statistical analysis [8]. This is while in the present study, RIS does not have a good relationship with other HISs, and the participants note that the specialized information about the disease is given to the patients on the CD or as images to be able to be used by professional or other colleagues. After all, although creating RIS at Kosar Hospital has not been able to save all information in an integrated way, so that it can be retrieved by the departments concerned, its weak relationship with the HIS has somewhat provided the access to specialized images. It should be noted that specialized radiology images could correctly be used only when reported by the radiologist that unfortunately, the specialized information regarding the reporting of radiologist is not recorded in RIS and only images are recoverable. Iwata et al. suggest that data integration in HIS is by forming an electronic file for each patient, where all hospital activities from admission to discharge are done [9]. It seems that, due to limitations, the possibility of integrating all data in HIS does not exist, and this change takes place gradually. The integration of this information enables recovery of all demographic, expert, and systemic information, but now there is only the possibility of retrieving images and demographic data in incomplete manner, and this can reduce the efficiency of RIS in Kosar Hospital. Adding patient demographic information completely along with the background, and the symptoms from admission systems and ward to RIS, and adding specialized information about diagnosis in RIS, so that they are easily retrievable could increase the efficiency of this system in the hospitals of Semnan University of Medical Sciences and have the advantages mentioned about the use of RIS.

Due to limitations listed in RIS of the hospitals affiliate of Semnan University of Medical Sciences, some of the functionalities of the system have been understandable for users and some benefits of it have not.

This was so that some users were able to understand features such as access to images, the possibility of archiving information, and search for information in information system understand, while some were dissatisfied with these capabilities of the system.

One of the users was a ward nurse stated, "All information is stored in a server. Images are saved for years, and it is a very good archive." Another staff also stated, "Information system has enabled me to see the images taken a few days ago, but if it were radiology image, we could not see the image after discharge."

Thus, to gain access to patients' images and disease records, it is necessary that the information system be capable of storing and archiving information, because this information integration causes the user to be able to have access to image data and disease records at any time from any part of the department. The results indicate that this information system has been successful in one part of the management of patient information, because the availability of information about the processes of storage, retrieval, and notification (distribution of information) are, in fact, among the characteristics of quality management.

Data should be readily available and usable whenever needed (for all clinical, administrative, and organizational purposes), otherwise their documenting and detailed recording are lost [7]. In their study in America with the aim of "Studying the effects of RIS / PACS system on professional performance of radiologists," Fredell et al. concluded that the use of this technology accelerates doctors' access to diagnostic images, increases specialized skills, and satisfaction [10]. Their study also showed that launching RIS / PACS is a factor to improve access to diagnostic images, provide better interpretation, increase efficiency, and ultimately user satisfaction [11].

In relation to the theme of system capacity at the entry and exit of information, the users were able to understand reporting capabilities, the patient's profile, and entering the required information. This was to an extent that many radiology staff said, "In this system everything is precise and can be checked. In this system, when a medicine is returned, I should check it. In the previous system, sometimes three or four days later, the accountant would say, for example, your paper does not have date, and it has problems, but now investigating is easier. The same goes for images. Moreover, in this system, I enter the patient's information services, accurate patient information with respect to the type of insurance, the service that should be done as directed by the doctor, and so on, everything is entered and exists."

Capacity of the system at the input and the obtaining output is one of the important points in RIS efficiency. High capacity in entering accurate and adequate information can increase satisfaction of information output. The study by Yaghmaei et al. regarding the involvement of the staff in attitudes towards computers showed that, computer systems and HIS have brought about easier access to patient's information. This issue is largely related to the proper and comprehensive insertion of information and the possibility to provide suitable and comprehensive output [12].

The results show that the presence of information systems in radiology has led the users to believe that RIS is more of a health care support than a hindrance, because this system is designed to support professional processes in the radiology department. This system has the responsibility for functions like registration and patient's follow-up, examination scheduling, reporting the results, film archive management, database management, auditing and accounting, as well as automatic fax of the reports to the related physician [13]. These capabilities of RIS work to improve hospital performance, as the findings of Yuçel et al. about the criteria used to evaluate HIS showed 63 percent performance improvement as one of the management benefits [14]. Moreover, in the study by Alipour et al. it was shown that by using this system, a significant decrease in the use of processes affecting the patient length of stay took place and improved hospital performance [15]. The findings of these studies are consistent with our study.

CONCLUSION

This study showed that hospital staff of training hospitals of Semnan has limitedly understood the capabilities of RIS. This was because of the limited capacity of this information system in information retrieval, image archiving, and limited data entry methods that had led the employees not to well understand the benefits of this information system.

CONFLICT OF INTEREST

There is no conflict of interest.

ACKNOWLEDGEMENTS

This research project was approved by the student research committee of Semnan University of Medical Sciences. We hereby appreciate the cooperation and financial support of the deputy of research and technology of Semnan University of Medical Sciences. We also thank the Clinical Research Development Unit of Kowsar and Amiralmomenin Educational, Research and Therapeutic Centers of Semnan University of Medical Sciences for providing facilities to this work.

FINANCIAL DISCLOSURE

None

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