

The Effect Of Digital Imaging On Radiography Work Practice

Mohamed M Abuzaid, Rasha Saad, W. Elshami, S. Alyafei

ABSTRACT: The use of digital imaging for the diagnostic purpose has been increased during last few years. This technique has brought advancement in the field of radiography. The effect of digital imaging on workflow has a direct relation with the performance of technologists. Aim: The predestined aim of this study was to analyze the use and influence of digital imaging on the workflow of the radiologists and also to demonstrate the effects on the overall performance of healthcare delivery. Method: A quantitative method of analysis is used in this study and the study instrument consisted of a questionnaire. The questions relates to the effect of digital imaging on workflow and image quality. Total of 100 questionnaires were distributed, and 82 of them were retrieved back. The inclusion criteria include healthcare providers who are radiographers, radiologist and radiology nurses. The healthcare providers of all ages, gender, and ethnicity, were included in this study. Results: according to 70.2% of the study participants, digital imaging has reduced the workflow and processes of radiography, whereas, 96.3% of the participants reported that digital imaging technique has improved their clinical performance. Conclusion: It is therefore concluded that digital imaging is a valuable in improving the quality of diagnosis in the field of radiography. Further, it is highly cost-effective, time-saving, digital imaging shows a positive and promising effect on the work practice of radiologists and also provides improved diagnostic results.

Keywords: Digital Imaging, Performance, Radiography, Work Practice

1.0 INTRODUCTION

The prevalence of digital imaging has been increasing rapidly in the work practice of radiography. This digitization technique of diagnostic imaging has expanded rapidly during the last decade. Digital imaging has great impact on the radiography workflow and affected directly the radiological technologist (RT) performance^[1-2]. This technique is used in the European hospitals for the purpose of diagnosis and the digital imaging and PACS have great effect on the work of radiographer. For instance, a review indicated the successful use of digital imaging and other imaging method for the purpose of angiography^[3]. The image quality, time-saving, network communication, image transfer and the digital storage considered as a major advantage and reduced the image production workflow. The manual handling of films belongs to the past since the revolutions of IT and images productions. A study based on literature review illustrated the importance of digital imaging and use of irreversible compression for the purpose of digital radiography^[3-4]. In addition, the major benefit of using digital imaging is that the distribution of digital imaging is more easily among the users as compared to the distribution of the film. The utilization of Digital image in education (teaching and learning) has great impact for undergraduate as well as continuous education. The digital image is effective because it can be used with high quality in presentations and this technique provides beneficial effects on the academic field^[2-4]. The limitation that was associated with the limited usage of specific number of films

or frames has been completely eradicated through the Electro Magnetic Ration. The patient file can be used as educational case study including full sets radiological procedure with the aid of EMR^[5]. In the present time, the PACS technologists and radiographers are competent professionals who use these methods in the diagnostic techniques for more advanced results in least time. The rapidity of this technique has increased its significance and acceptability with the passage of time^[5-6].

2.0 METHODOLOGY

The method which was used to conduct this study was cross section quantitative questionnaire. It is a quantitative research in which the questionnaire was used as the research instrument. The questionnaire utilized in the study consists of a variety of open or close-ended questions for the purpose of data collection. The collection of statistical information was also carried out by using this method. This questionnaire comprised of a list of well- designed questionnaire for determining the response of the participants for analyzing the effects of digital imaging on radiography^[7]. A questionnaire can be defined research instrument that consists of series of open or close-ended or both questions for the collection of data relevant to a study. The questionnaire is an effective method utilized for collection of statistical information. The questionnaire extracts specific information from the participants of the study. Furthermore, it serves four basic purposes, i.e., collection of appropriate data, to make data comparable and amenable to analysis, to minimize bias in formulating and asking question, and to make questions engaging and varied. The main method which was used for data collection was carried out by designing well organized questionnaire and distributing it to the health care provider including (radiographer-radiologist & radiology nurses)^[7].

Experimental design

The questionnaire contained the questions related to the influence of digital imaging on radiology work practice. This questionnaire was distributed among the government hospitals and clinics in Sharjah – Ajman – Rak Al Kaima & Dubai. The sample size of 100 participants was used to

- *Medical Diagnostic Imaging Department, University Of Sharjah, United Arab Emirates.*
- *School Of Pharmacy, Management and Science University, Shah Alam, Malaysia.*
- *Radiography And Medical Imaging Department, Fatima College Of Health Sciences, United Arab Emirates.*

Corresponding Author: Mabdelfatah@Sharjah.Ac.Ae or Mohdfatah76@gmail.Com

conduct the study. After the distribution of questionnaire, the number of sample returned was 82. There were 18 questionnaires that were missed due to some issues, for instance, some healthcare providers were on vacation and some of them were uncooperative. In addition, there were some missing data during collection of the questionnaire and analysis. Therefore, these were considered incomplete questionnaires and were excluded. The duration of the study extended from the beginning of March 2014 until the end April 2014. The questionnaire was distributed in the form of hard copy and a written consent form was obtained from Ministry of Health by email. The questionnaire was categorized into four groups according to the effect of digital imaging in radiology. The first part of the questionnaires included questions about demographics of the participants. Part two of the questionnaire was composed of questions about the effect of digital imaging in workflow of radiology. Part three of the questionnaire included the questions about the effect of Digital Imaging in the radiology profession. The last part of the questionnaire was composed of the questions regarding the effect of digital imaging in image quality. In the selection of the participants, there were no age, gender or ethnicity limits considered. The questionnaire was consisted of total 20 questions.

Data Analysis

The first analysis of data was carried out through manual method and after the manual analysis, the information were set on the Microsoft office “ Xcel “ program and this information was explored by using statistical tool of SPSS software.

3.0 RESULTS

A total of 82 questionnaires were distributed and all 82 were completed and returned. Among these respondents, 74(90%) indicated that digital Imaging have reduced the procedures steps whereas, minority of the respondents 2 (2%) disagreed with it and 3 (7%) were having a neutral opinion about it. But majority of the respondents 78 (95%) agreed with the fact that, digital imaging have resulted in the reduction of the numberof reject images (Table1) and (Figure 1).

Table 1: Effect of Digital Imaging on Radiology

Statement	Degree	1	2	3	TOTAL
DI reduce steps	NO	74	2	6	82
	%	90.2%	2.4%	7.3%	100.0%
DI reduce the number of reject images	NO	78	1	3	82
	%	95.1%	1.2%	3.7%	100.0%

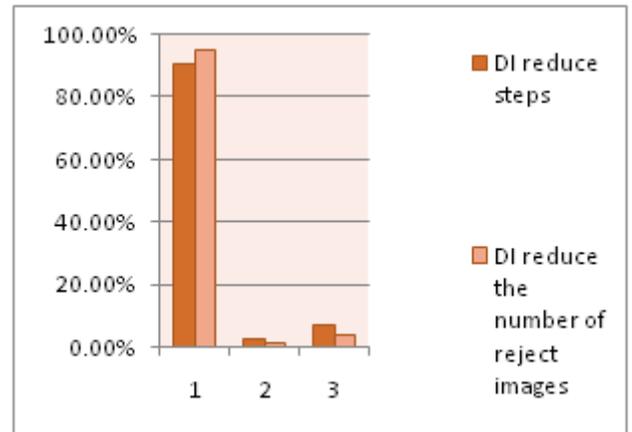


Figure 1: % of the effect of Digital Imaging on Radiology

In the next question (Table 2) and (Figure 2), respondents were questioned about the improvement in performance and any hindrances they faced due to digital imaging. Majority of the respondents 78(95%) said that digital imaging have helped them in improving their performances and 76 (92%) of the respondents said they did not face any issue with its use.

Table 2: The Improvement in the Performance and Less Frustration due to DI

Statement	Degree	1	2	3	TOTAL
DI improve performance	NO	78	2	2	82
	%	95.1%	2.4%	2.4%	100.0%
DI less frustration than using film	NO	76	0	6	82
	%	92.7%	0.0%	7.3%	100.0%

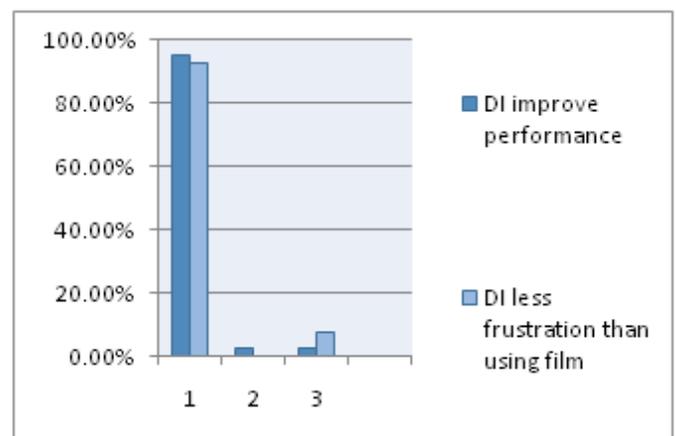


Figure 2: The Percentages of improvement in the Performance and Less Frustration due to DI

In Table 3 and Figure 3, it shows the effect of using Digital Imaging to the storage capabilities and image query retrieval. According to the results, it was found that 79 (96%) of the participants agreed that the digital imaging would positively impact the storage capabilities. Also 79

(95%) of the participants agreed that the image query and retrieval could be affected in a positive way.

Table 3: Image Storag, Query and Retrieve

Statement	Degr ee	1	2	3	TOT AL
Storage capabilities	NO	79	0	3	82
	%	96.3	0.0	3.7	100.0
Image query and retrieve	NO	78	1	3	82
	%	95.1	1.2	3.7	100.0

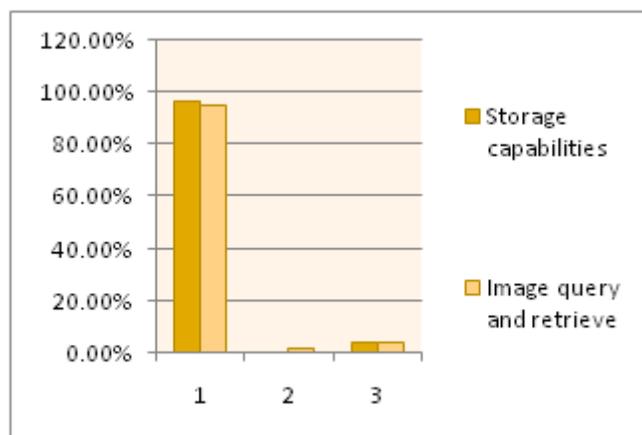


Figure 3: The percentages of image Storag, Query and Retrieve

Since the p-value is greater than 5% or 0.05, this value indicates that there is no difference between the means. But, according to the results above, p-value is $0.01 < 0.05$ which proves that the correlation was significant.

4.0 DISCUSSION

The results of the study indicated that the performance of the radiographers working in any health care system is dependent on the implementation of the digital imaging. This result is supported by another study that was conducted to analyze the changes that are occurring in the radiological department due to the development and advancement of digital image techniques. This study indicated that the work environment and the workflow are influenced by the implementation of the techniques like digital imaging [8]. The performance of the professionals using the advanced techniques also affects the retrieving efficiency of image queries and problem. This depends on the efficiency of the radiographer and his handling of digital imaging [5-6]. The scope of the radiographers increases in their field and this affects the performance of the radiographers. The use of advanced techniques, for example the use of digital imaging in the field of radiography has increased the competencies of the radiographers. The results of this study also justified this statement of the literature as the performance of radiographers is affected by the use of advanced digital imaging [8-9]. The results of this study showed a direct relationship between the digital imaging and work practice

of radiographers. The similar results were found in the previous studies that were conducted for the analysis of effect of digital imaging on the work practice of radiologists [9-11]. The effectiveness of the digital imaging for the diagnosis of dento-alveolar trauma was carried out. This study indicated that the use of digital imaging for the production of three dimensional imaging is very effective for the radiologist to diagnose the problem effectively and in less time [11-12]. The accuracy and rapidity of digital imaging for the diagnosis showed increased performance and decreased frustration among radiographers [13-14]. The association of the digital imaging with the data storage and use of film combination approach has increased the demand of use of digital imaging for the diagnostic purpose [15-16]. The linking of the software with digital imaging provides an effective command to use the diagnostic data in the clinical practices [17-18].

5.0 CONCLUSION

This study concluded that the performance of the radiographers working in any health care organization is directly affected by the use of digital imaging. The digital imaging technique not only improves the performance of the radiographers but also increases the workflow of the health care hospitals or clinics. The use of digital imaging has increased the efficiency of imaging queries and retrieving the results through film combination. The limitation to this study is that the sample size of the study was very small, and study was conducted in the participants of confined areas. There is an imperative need to conduct further advanced studies with larger sample size [19-20].

REFERENCES

- [1] Kotre, CJ, Marshall NW. A review of image quality and dose issues in digital fluorography and digital subtraction angiography. *Radiation protection dosimetry* 2001; 94(12): 73-6. Retrieved from, <http://rpd.oxfordjournals.org/content/94/1-2/73.short>
- [2] Cabrera A. Defining the role of a PACS technologist. *Journal of digital imaging* 2002; 15: 120-3. Retrieved from, <http://www.springerlink.com/index/UHTX3N41RA0LDMGW.pdf>
- [3] Carrino, JA. Digital imaging overview. In *Seminars in roentgenology*. WB Saunders. 2003;38 (3): 200-215.
- [4] Foord, K. Year 2000: status of picture archiving and digital imaging in European hospitals. *European radiology* 2000; 11(3): 513-24. Retrieved from, <http://link.springer.com/article/10.1007/s003300000657>
- [5] Larsson, W., Aspelin, P., Bergquist, M., et al. The effects of PACS on radiographer's work practice. *Radiography* 2007; 13(3): 235-40. Retrieved from, <http://www.sciencedirect.com/science/article/pii/S1078817406000186>
- [6] Lau, S L, Mak, A S H, Lam, WT, Chau, CK, Lau, KY. Reject analysis: a comparison of conventional film-

- screen radiography and computed radiography with PACS. *Radiography*, 2004, 10(3), 183-187. Retrieved from, <http://www.sciencedirect.com/science/article/pii/S1078817404000719>
- [7] Larsson W, Lundberg N, Hillergård K. Use your good judgement–Radiographers' knowledge in image production work. *Radiography* 2009; 15(3): e11-21. Retrieved from, <http://www.sciencedirect.com/science/article/pii/S1078817408001016>
- [8] Fridell K, Aspelin P, Edgren L, Lindsköld L, Lundberg N. PACS influence the radiographer's work. *Radiography* 2009; 15(2): 121-33. Retrieved from, <http://www.sciencedirect.com/science/article/pii/S107881740800028X>
- [9] Strickland, N H. PACS (picture archiving and communication systems): filmless radiology. *Archives of disease in childhood*, 2000; 83(1), 82-86. Retrieved from, <http://adc.bmj.com/content/83/1/82.full.html>
- [10] Wenzel A., Møystad A. Work flow with digital intraoral radiography: a systematic review. *Actaodontologica Scandinavica*, 2010; 68(2), 106-114. Retrieved from, <http://informahealthcare.com/doi/abs/10.3109/00016350903514426>
- [11] Compagnone G., Baleni M C., Pagan L, Calzolaio F L, Barozzi L, Bergamini C. Comparison of radiation doses to patients undergoing standard radiographic examinations with conventional screen–film radiography, computed radiography and direct digital radiography. 2014. Retrieved from, <http://www.birpublications.org/doi/full/10.1259/bjr/57138583>
- [12] Prabhu, S P., Gandhi S, Goddard P R. Ergonomics of digital imaging. *Ergonomics*, 2014; 78(931). Retrieved from, <http://www.birpublications.org/doi/full/10.1259/bjr/51650129>
- [13] Hellén-Halme K, Nilsson M., Petersson A. Digital radiography in general dental practice: a field study. 2014. Retrieved from, <http://www.birpublications.org/doi/full/10.1259/dmfr/95125494>
- [14] Seeram E. Irreversible compression in digital radiology. A literature review. *Radiography* 2006; 12(1): 45-59. <http://www.sciencedirect.com/science/article/pii/S107881740500057X>
- [15] Haak R, WichtMJ, Nowak G, and Hellmich M. Influence of displayed image size on radiographic detection of approximal caries 2014. <http://www.birpublications.org/doi/full/10.1259/dmfr/17654484>
- [16] Bryman A. *Social research methods*. Oxford University press 2012. https://books.google.com/books?hl=en&lr=&id=vCq5m2hPkOMC&oi=fnd&pg=PP2&dq=advantages+of+quantitative+studies&ots=CKNiGp4_rw&sig=8-VZs9SKzwl6ehFvgzURzsHxEY
- [17] Barrett HH, Swindell W Eds. *Radiological imaging: the theory of image formation, detection, and processing*. Elsevier, 2012. https://books.google.co.uk/books?hl=en&lr=&id=jzy2HqCzFQC&oi=fnd&pg=PP1&dq=significance+of+image+detection+in+radiography&ots=AYipKQgvuQ&sig=2WaJ-FrnVirffSv98E-VGk_F3bY
- [18] Cohenca N, Simon JH, Roges R, Morag Y, Malfaz, JM. Clinical indications for digital imaging in dento-alveolar trauma. Part 1: traumatic injuries. *Dental Traumatology* 2007; 23(2): 95-104. <http://onlinelibrary.wiley.com/doi/10.1111/j.1600-9657.2006.00509.x/full>
- [19] CanessaJC, Canessa G, Canessa G G, Guan S. U.S. Patent No. 7,120,644. Washington, DC: U.S. Patent and Trademark Office, 2006. <https://www.google.com/patents/US7120644>
- [20] Rasha Saad, Jiyauddin Khan, VivegananthKrishnanmurthi, FadliAsmani, Eddy Yusuf: Effect of Different Extraction Techniques of *Persicaria odorata* Extracts Utilizing Anti-bacterial Bioassay. *British journal of Pharmaceutical Research*. 09/2014; 4(4):2146-2154.