Conversion of radiology department into a digital workflow: radiographers' overview

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ABSTRACT

Digital Imaging continues to evolve rapidly as technology improves. Computed radiography and Digital radiography is the latest advancement in diagnostic imaging and is slowly being adopted by the radiology departments, radiologic technologist, patients and other medical professions. Digital imaging incorporates computer technology in the capture, display, enhancement and storage of direct radiographic images. Digital imaging offers some distinct advantages over film but like any emerging technology, it presents new and different challenges for the radiologic technologists and radiology department to overcome. That is why this study seeks the perception of the Radiologic Technologists about the Conversions of Radiology Departments into a digital workflow and the possible problems they would encounter and the possible solution they should implement to solve such problems. Results of the study revealed that most of the radiologic technologists believed that conversion into a digital workflow will give additional income to the radiology department and of course to the hospitals. And majority of the respondents point of view that poor foundation of radiologic technologists' technical skills will be their first problem when conversion happens. Generally, Radiologic Technologist students practice the traditional skills in their field of expertise and the conversion of Radiology Department into digital workflow will be difficult to them to shift from traditional to modern and new one. Respondents gave highest assessment on the school implementation to add new curriculum of latest technology for the enhancement of radiologic technology students' skill as their counter measures to such problem.

Keywords: radiologic technogists, perception, digital imaging, radiology department

INTRODUCTION

Since the discovery of x-rays in 1895 film has been the primary medium for capturing, displaying and storing radiographic images. It is an invention that technologists are the most familiar and comfortable with in terms techniques and maneuvers.

The world of x-ray is always changing. The name of the field, radiologic technology, alone gives the indication that the latest technology is used in the profession.

Computed radiography and Digital radiography is the latest advancement in diagnostic imaging and is slowly being adopted by the radiology departments, radiologic technologist, patients and other medical profession. More and more radiology departments are converting from conventional radiography departments to digital imaging departments with complicated computers. In the middle of all the conversion we the researchers, as the student of Bachelor of Science in Radiologic Technology become interested about the perception of the Radiologic Technologist on Batangas Province towards the conversion of radiology department into a digital workflow.

Diagnostic imaging departments have a dual mission that requires them to maintain the highest quality and consistency of patient care while maximizing efficiency and productivity. With the increasing financial pressures placed on imaging providers these goals often become mutually exclusive.

Digital imaging can be broken down into two categories: computed radiography and digital radiography. Computed radiography (CR) is a way to capture x-rays in a digital format using a cassette and laser reader system. Digital radiography (DR) another category under the umbrella of digital imaging does not use cassettes. Digital radiography can be referred to as DR or a cassette-less system

How digital image formed? As the laser translates the information into a digital signal it will read from the center of the film to the collimated edge. The information that is within the collimated field is put into a graph. This graph is called a histogram. Digital radiography systems use a flat-panel detector to capture the X-rays once they have passed through the patient. Direct converters absorb x-rays in an amorphous selenium material called a scintillator then converters absorb x-rays in an amorphous selenium material called a scintillator then convert the x-rays into a digital signal. The scintillator used for in-direct conversion captures the x-rays and then converts the x-rays to a visible signal. The visible signal then interacts with a photodetector which converts the visible signal into a digital signal.

A big part of how the final image looks is to do with the matrix it is viewed on. A matrix is a collection of many boxes that forms a digital image. An entire TV is considered a matrix as is the computer monitor considered a matrix. What makes on matrix different from the other is the number of boxes, called pixels contained within the matrix. A pixel is one box, the smallest visible unit of an image. As the number of pixels increase in a matrix so does the resolution of the image.

Maybe one of the greatest advantages for a health care system that comes with a digital imaging system is the lack of storage space needed. No longer will hospitals and clinics need to rent out warehouse buildings to store every x-ray for every patient for at least 7 years. So, where are all the x-rays going? Well, into a PACS of course! Picture Archiving and Communication System (PACS) are computers or networks dedicated to the acquisition, storage. Distribution and presentation of image in DICOM format while DICOM means Digital Imaging and Communication in Medicine.

METHODS

Respondents

This study involved 50 radiologic technologists from selected radiology department herein Batangas Province. The radiology departments which served as research environment of this study where the following: N.L. Villa Memoerial Medical Center, Saint Frances Cabrini Medical Center, Mary Mediatrix Medical Center, Queen Mary Hospital, Metro Lipa Hospital, Palma-MalaluanHspital, MahalnaVirgen Mario Sto. Rosario District Hospital and Lipa City District Hospital.
Instrumentation and Data Collection

A three-part research structured questionnaire was prepared and served as the primary data gathering instrument.

Part I dealt with the respondent's insights towards the conversion of radiology department into a digital workflow.

Part II dealt with the radiologic technologists' response on the possible difficulty they might encounter.

Part III dealt with their response on the possible counter measures, the department may implement.

Data Analysis

The data collected were tabulated, analyzed and interpreted.

Weighted mean was used to determine the view of radiologic technologists on Batangas Province about the conversion of radiology department into a digital workflow. After the total value of each item was computed the weighted mean score for each item was determined using the formula:

WM = (TV/N)
TV=f1v1+f2v2+f3v…+fnvn

Where:

WM = weighted mean
TV = total value
N = total value of respondents
f = frequency of respondents for every scale
v = value of scale

Inter quartile range was also used to determine the range of each scale. Inter quartile range is method of measuring the spread of the numbers by finding the middle 50% of the values. This was determined using the following formula:

IQR = Q3-Q1
Q3 = ¾ (n+1)
Q1 = ¼ (n+1)

Where:

IQR = inter quartile range
Q3 = upper quartile
n = number of data value in the set

Scale	Value	Range
SA = Strongly Agree	4	3.5 – 4.0
A = Agree	3	2.5 – 3.5
DA = Disagree	2	1.5 – 2.5
SDA = Strongly Dissagree	1	1.0 – 1.5

RESULTS

Table 1
Radiologic Technologists' response on the insights toward the conversion of Radiology Department into Digital Workflow

Parameter	WM	Verbal Interpretation	Rank
1. The hospital will become popular	3.54	Strongly Agree	2
2. It will give additional financial income on the hospital	3.64	Strongly Agree	1
3. It will lessen the work of radiologic technologists	3.24	Agree	4
4. Less doubt in the quality of the result produced bythe equipment	3.20	Agree	5
5. It will speed up the processing of patients' examination	3.42	Agree	3

Table 1 illustrates the respondents' assessment on their insights towards the conversion of Radiology Department into Digital Workflow. It shows that the perception that will give additional financial income on the hospitals (parameter number 2) was strongly agreed by most of the respondents. This perception was given the highest assessment with the weighted mean of 3.64. In line with the increase of financial income in the hospital comes together with the popularity of the hospital as well. The perception that the hospital will become popular (parameter number 1) was ranked in number 2 with the weighted mean of 3.54 which also falls in strongly agree scale. On the other hand, the perception of less doubt in the quality of the result produced by the equipment (parameter number 4) was agreed by the respondents and was given the lowest assessment with the weighted mean of 3.20.

Table 2
Radiologic Technologists' response on the possible problems in the Conversion of Radiology Department into Digital Workflow

Parameter	WM	Verbal Interpretation	Rank
Lack of hospital budget to purchase the equipment	3.46	Agree	2
Lack of highly qualified staff and personnel	3.44	Agree	3
Hardware error handling of radiologic technologists in the equipment	3.20	Agree	5
Expensive to the patient to afford digital examination	3.38	Agree	4
Poor foundation of radiologic technologists technical skills	3.54	Strongly Agree	1

Table 2 shows the Radiologic Technologists response on the possible problems in the Conversion of Radiology Department into Digital Workflow. The problem of poor foundation of Radiologic Technologists technical skills (parameter number 5) was given the highest judgment with the weighted mean of 3.54. Respondents strongly agreed that giving the first priority to solve this possible problem under parameter number 5 will automatically lessen other possible problems in the conversion into digital workflow. The problem of Hardware error handling of Radiologic Technologists in the equipment (parameter number 3) falls in the agree scale and was given the lowest assessment by the respondents with the weighted mean of 3.2.

Table 3
Radiologic Technologists' response on the possible counter measures to the problem in the Conversion of Radiology Department into Digital Workflow

Parameter	WM	Verbal Interpretation	Rank
1.Seek government financial support for non-private hospitals and discounted amount for private one	3.46	Agree	3.5
2. Monthly seminar/training of radiologic technologists for this technology.	3.2	Agree	5
3. Orientation of radiologic technologists for the basic trouble shooting of the equipment	3.46	Agree	3.5
4. Proper advertisement of the benefits and quality of the technology to the patient.	3.5	Agree	2
5. School implementation of modifying the existing curriculum to include the latest technology for the enhancement of radiologic technology students' skills	3.7	Strongly Agree	1

Table 3 shows the Radiologic Technologists' answer on the possible counter measures to the problem in the conversion of Radiology Department into digital workflow. Respondents gave highest assessment on the school implementation of modifying the existing curriculum to include the latest technology for the enhancement of Radiologic Technology students' skills (parameter number 5) with the weighted mean of 3.7. Majority of the respondents strongly agree that the initiative to develop the students' skill must start in the schools and universities by reviewing the curriculum and adding the latest technology in their practice to widen the skills of the students for the preparation of the world of medicine. Monthly seminar/training for Radiologic Technologists for this equipment (parameter number 2) drops in the agree scale and was given the lowest assessment with the weighted mean of 3.2.

DISCUSSION

Based on the results gathered from the conducted surveys among the selected radiologic technologists in the Batangas Region, Conversion of Radiology Department into Digital Workflow has a positive acceptance and viewpoints.
From the respondent's (Radiologic Technologists) viewpoint, the result of our study showed that, switching into a digital workflow will leads the radiology department/ hospitals to popularity. Hence, it will leads the radiology department/hospitals. On the other hand, there is still small percentage of doubt on the quality of the equipment output.

Digital imaging offers some distinct advantages over film but like any emerging technology, it presents new and different challenges for the radiologic technologists and radiology department to overcome. One of them is the poor foundation of radiologic technologists' technical skills which mainly establish in the schools and universities. Duly, radiologic technologist students practice the traditional skills in their field of expertise and the conversion of radiology department into digital workflow will be difficult for them to shift from traditional to modern and new one especially if they don't have any background skills on the latest technology. Building and enhancement of the skills of the radiologic technologists must begin in their nurturing alma mater. The initiative to develop the students' skills must start in the schools and universities by reviewing the curriculum and adding the latest technology in their practice to widen the skills of the students for the preparation in the world of medicine.

The other obstacle to keep in mind with trying to increase the kVp and decreasing the mA to decrease the patient's radiation dose is how sensitive digital imaging systems are to scatter radiation. With an increase in kVp you have an increase in the production of scatter radiation. The morale of the story is to use As low As Reasonably Achievable (ALARA!)

According to Tracy Hermann, The digital environment may offer greater flexibility in imaging options and opportunities to reduce radiation doses with DR, but medical imaging professionals should understand that this flexibility could result in inconsistent diagnostic results if the system and PACS are not appropriately calibrated. Multiple clinical reports have highlighted the possibilities for diagnostic ambiguity or inaccuracy with poorly calibrated digital equipment and technologists should be familiar enough with the system, including its communication with the PACS that there problems can be avoided. Also, though digital modalities have demonstrated the ability to provide sufficient diagnostic CR and DR in specific detection capabilities.

Radiation is a known carcinogen and too much exposure to this energy may cause cancer. It is absolutely vital for radiologic technologists who is working with digital imaging to learn everything they can because the more understanding they acquire about the equipment, the safer they can use it. It is the responsibility of the radiologic technologist to stay current with the new technologies to ensure best practices are being employed, which includes ALARA!

The result of this study did not actually forced the hospitals/ radiology department to convert into a digital workflow but only to give an assessment on what the radiologic technologists' outlook is this switching happened.

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