Quality assurance practices among radiologic and x-ray technologists at Oriental Mindoro, Philippines

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ABSTRACT

Radiologic technologists are highly trained allied health practitioners who have both a professional and ethical duty to protect patients, coworkers and themselves from excessive ionizing radiation during medical diagnostic and interventional procedures following quality assurance practices. Previous studies revealed that there is a poor compliance with the safety practices, especially those that reduce unnecessary exposure to personnel and the patients as well. Exposure to ionizing radiation was found out to produce biochemical effects such as genetic, carcinogenesis, mutagenic and other harmful effects. The purpose of this study is to determine the degree of compliance of the radiologic and x-ray technologists working at Oriental Mindoro, Philippines with quality assurance practices and correlate such compliance with the demographic profile with the goal of reducing the radiation dose among themselves and their patients. Results of the study revealed that many of the respondents are middle aged adults, married, finished Associate in Radiologic Technology, licensed as X-ray technologist and worked in the hospital as X-ray technicians for more than 5 years in the field of radiography. They had participated thrice or less per year in continuing professional education. It also showed that there are few licensed Radiologic Technologists in the said area. Based on the results, most of the quality assurance practices in terms of personal (patient care and management, and quality assurance management) and clinical skills (pre-exposure, exposure, and post exposure examination) are always exhibited by the respondents. However, there are aspects particularly in patient care and management and before and after examination, that were only performed often. The assessment on the personal skills is affected by their civil status and place of work. On the other hand, the assessment on the clinical skills is not affected by their profile. It is therefore recommended that the identified skills which were rated often be addressed and continuous assessment on the compliance of the staff in diagnostic imaging departments be performed.

Keywords: quality assurance,radiation safety practices, x-ray, Radiologic Technologists

INTRODUCTION

Radiologic technologists are highly trained allied health practitioners who play an important role in today's health care delivery system. The role and the work that they do have continued to evolve since the occupation was created over 100 years ago (Marshall and Keene, 2007).

Technological advancements in Radiology since the discovery of x-rays have been overwhelming with an impressive array of diagnostic and therapeutic equipment presently available. Aside from routine diagnostic radiography, many specialties have emerged such as Nuclear Medicine, Radiation Therapy, Ultrasound, Computed Tomography Scan, Magnetic Resonance Imaging (MRI), Mammography, Bone Mineral Densitometry, and Interventional Radiology creating high demand for individuals in this field (CMO 18 s. 2006; Jensen, 2007). Radiologic technologists become involved in using high-frequency sound waves (diagnostic medical sonography) and magnetic fields and radio waves (MRI) to create images of the internal anatomy of the body (Adler and Carlton, 2007).

All fields of medicine and all hospital departments are required to develop and conduct programs that ensure the quality of patient care and management. Diagnostic imaging departments are leaders in promoting quality patient care (Bushong, 2008). The use of various imaging techniques greatly enhances the ability to manage anatomic motion and mitigate errors. At the same time, it affords a new challenge of how to effectively ensure the functionality and performance of the image-guided procedure on a routine basis (Timmerman and Xing, 2010). Radiology imaging equipment should produce an image which meets the needs of the radiologist or other interpreters without involving unnecessary irradiation of the patient. Quality assurance actions contribute to the production of diagnostic images of a consistent quality by reducing the variations in performance of the imaging equipment.

The practice requires the knowledge necessary for the Radiologic Technologists to perform their tasks with confidence, effectiveness, and efficiency in patient care and management and the operation of specialized equipment in a competent and safe manner (CMO 18 s. 2006).

One of the first things taught in radiologic technology programs is the cardinal principles of radiation protection (Marshall and Keene, 2007; Sherer et al, 2011). It is the key responsibility of radiologic technologists to provide optimal diagnostic images while using the lowest radiation dose possible (Colangelo et al., 2009).

Radiologic technologists have both a professional and ethical duty to protect patients, coworkers and themselves from excessive ionizing radiation during medical diagnostic and interventional procedures. The practice guidelines and technical standards recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques. It is important that radiologic technologists understand and implement these practice guidelines, or relate them to existing institutional practice guidelines to ensure optimal patient and technologist safety (Colangelo et al., 2009). They are responsible for protecting the public from unnecessary or excessive radiation exposure.

When fulfilling professional responsibilities associated with diagnostic imaging, radiologic technologists may be exposed to secondary radiation (scatter or leakage). Some x-ray procedures increase the radiographer's risk of exposure (Saia, 2009; Sherer et al., 2011). About 60% of human-made radiation exposures are from medical x-rays (Shrader-Frechette, 2007). To the general public, diagnostic X-rays are a principal source of exposure to potentially carcinogenic man-made ionizing radiation (Jensen, 2007).

As physicians continue to make greater use of higher-dose imaging modalities such as computed tomography (CT) and interventional procedures, there is increasing concern that the public may be exposed to a greater radiation dose. The use of CT and interventional fluoroscopic procedures continues to increase because of the tremendous diagnostic specificity of these sophisticated imaging modalities. Improvements in image quality and therapeutic technologies such as cardiac catherization may account for the increase in the use of fluoroscopically guided interventional techniques. Because of their increased use, radiation dose to patients and operators are also increasing (Colangelo et al., 2009).

Several studies have proven the harmful effects of radiation. Radiation exposure decreases the number of all precursor cells, which reduces the number of mature cells in the circulating blood. Lymphocytes and spermatogonia are considered the most sensitive cells in the body. The effects of low-dose, long-term irradiation in utero can include prenatal death, neonatal death, congenital abnormalities, malignancy, impairment of growth, genetic effects, and mental retardation. Local tissues can also be affected by low-dose radiation. The late effects appear as nonmalignant changes in the skin, showing a weathered, callused, and discolored appearance. Chromosome damage in circulating lymphocytes and cataracts in the lens of the eye have been observed as late effects of radiation exposure (Bushong, 2007). Radiation-induced changes to neural tissue are now known to include visual deterioration, hearing loss, hormonal disturbances, vasculopathy, brain and bone necrosis, atrophy, demyelination, calcification, fatty replacement of bone marrow, and induction of central nervous system neoplasms (Al-Mefty at al. and Rabin et al. as cited in Umansky et al., 2008). Exposing to ionizing radiation has been shown to significantly increase the risk of meningioma (Umansky et al., 2008) and breast cancer (Andrieu et al., 2006; Ronckers et al., 2008; Schmitz-Feuerhake and Pflugbeil, 2011).

In the study of Berrington et al. (2001) among British radiologists, it was revealed that there was evidence of an increasing trend in risk of cancer mortality for those registered for more than 40 years. Curtis (2010) concluded that the possibility of radiation-induced carcinogenesis is real and everyone must be proactive in its prevention.

The radiologic technologists play an important role in the radiation protection equation that includes adhering to strict protective guidelines, avoiding unnecessary exposures and remaining current with radiation biology and radiation protection continuing education (Fosbinder and Kelsey, 2002; Colangelo et al., 2009). Therefore, radiation protection practice for both patients and personnel is fundamental to every aspect of the radiologic technologist's role.

However, Reagan and Slechta (2010) revealed that there was a poor compliance with the safety practices, especially those that reduce unnecessary exposure to personnel. Marshall and Keene (2007) added that as time progresses in some technologists' career, they tend to forget the importance of some of the basic, yet essential radiation safety practices they once learned. It is common place to see technologists holding patients during procedures, a practice clearly taught against in radiologic technology education programs and in medical literature. Also, technologists may sometimes be seen in procedure rooms during exposures without even wearing a lead apron. Clearly, the field of diagnostic radiology is changing, putting pressure on technologists to produce quality images in very short periods of time, which can lead to technologists putting themselves or others in harm's way. New technologies allow for patients to be overexposed routinely, and also allow for repeats to be taken quickly, making it easier for a technologist to multiply the patient's dose without considering the implications.

Radiation dose from medical imaging is increasing at an alarming rate. In the study of Johnston et al. in 2011 among the radiologic technologists in the United States, 48% indicated that they never received regular in-service training on radiation dose issues. It was observed that other technologists are not shielded when performing the examination. It was also found out that less is being done to reduce dose when adult patients are scanned. They suggested that there needs to be an element added to the current approach to addressing radiation dose.

Radiologic technologists are the individuals with the last opportunity to reduce patient dose in the chain of events leading to an exposure (Watson, 2010). Johnston et al., (2011) found out that the commonly recognized and accepted methods of radiation protection practices are being applied to reduce dose of patients, but not routinely so. They suggested that the skills require periodic updates and reminders.

In the Philippines, particularly in Oriental Mindoro, the number of registered radiologic technologists who are working in the hospitals and healthcare facilities is limited. Thus, the use of different imaging modalities may also be performed by the x-ray technologist. Likewise, the laws and regulations concerning quality assurance practices exist. However, an effective system of enforcement is still lacking.

This study seeks to determine the degree of compliance of the radiologic and x-ray technologists with the quality assurance practices and correlate such compliance with the demographic profile with the goal of reducing the radiation dose among themselves and their patients.

METHODS

A descriptive-purposive research design was used in the study. The researchers formulated a questionnaire patterned from Bushong (2007), which was subjected to face validation with their adviser and panel of experts to achieve clarity and ease of administrability of the instrument.

Participants

The study involved the radiologic and X-ray technologists employed in the hospitals, X-ray and CT scan laboratories in Oriental Mindoro, Philippines.

Procedure

After the instrument has been validated, the questionnaire, which is the main tool for gathering data, was reproduced for the respondents of the study. The completed questionnaires were tabulated, analyzed and interpreted.

Statistical Tool

Frequency distribution, mean and verbal Interpretation using the Five-Likert Scale Method were used as the statistical tools in determining the compliance to quality assurance practices. Eta test was used to correlate the assessment on the personal and clinical skills required for examination with the demographic profile of the respondents.

RESULTS AND DISCUSSION

I. Respondents' Demographic Profile

Table 1 presents the demographic profile of the twenty-three (23) respondents, representing 88.46% of the total Radiologic Technologists and X-ray technologists/ technicians working in the seven (7) hospitals and three (3) clinics in Oriental Mindoro, Philippines.

In terms of gender, there is an equal distribution of 11 or 47.80 percent out of the total population of 23 for both male and female respondents.

In terms of age, nearly half (47.80%) were on the 36-40 years old range, followed by those in the 41-56 age range (21.70%) and then 31-35 age range (13%). It can be seen from the results that the respondents are middle-aged adults.

In terms of civil status, many (69.60%) are married while 17.40% are single. Three (3%) did not indicate their civil status. Many of the married respondents preferred to work in Oriental Mindoro due to the proximity to their residences.

In terms of the highest educational attainment, most (78.30%) respondents had finished Associate in Radiologic Technology while few (21.50%) had obtained the Bachelor's degree. This shows that many of the respondents did not pursue the Bachelor degree after obtaining the Associate degree. This may be due to the fact that during their time, a ladderized curriculum is offered such that after the three-year program, a graduate can already work as x-ray technologist.

Table 1
Distribution of the Respondents' Demographic Profile
N = 23

Demographic Profile	Frequency	Percentage (%)
Gender		
Male	11	47.80
Female	11	47.80
No Response	1	4.30
Age		
Below 25 years old	1	4.30
26 – 30 years old	2	8.70
31 – 35 years old	3	13.00
36 – 40 years old	11	47.80
41 – 45 years old	5	21.70
46 – 50 years old	1	4.30
Civil Status		
Single	4	17.40
Married	16	69.60
No Response	3	13.00
Highest Educational Attainment		
Bachelor's Degree	5	21.70
Associate in Radiologic Technology	18	78.30
Licensed as		
Radiologic Technologist	4	17.40
X-ray Technologist	14	60.90
Not licensed	5	21.70
Workplace		
Hospital	20	87.00
Clinic	2	8.70
Others	1	4.30
Present Position		
Chief Technologist	4	17.40
X Ray Technician	13	56.50
Staff	1	4.30
Radiologic Technician	1	4.30
No Response	4	17.30
Number of Years in Professional Practice		
Below 5 years	9	39.10
6 – 10 years	3	13.00
11 – 15 years	4	17.40
16 – 20 years	6	26.10
No Response	1	4.30
Primary Area of Practice		
Radiography	15	65.20
Computed Tomography	1	4.30
Equal time in both	5	21.70
No Responses	2	8.70
Participation/Attendance to (CPE)		
Always (>7 CPE/year)	2	8.70
Often (5-6 CPE/year)	9	39.10
Sometimes (3-4 CPE/year)	6	26.10
Seldom (1-2 CPE/year)	3	13.00
Never (0 CPE/year)	2	8.70
No Response	1	4.30

Multiple Response

In terms of licensure examination, many (60.90%) are licensed as X-ray Technologist, 21.70% are not licensed while only 17.40% are licensed as

Radiologic Technologist. Thus, there are few registered radiologic technologists working in Oriental Mindoro.

In terms of workplace, most respondents (87%) work in the hospital while 8.70% work in the clinic. This is due to the fact that in the hospital, various cases can be encountered which enable them to use various modalities.

In terms of position, more than half (56.50%) of the respondents are employed as X- ray Technicians and 17.40% of them are Chief Radiologic Technologists.

In terms of number of years in professional practice, 39.10% have served in less than five years, 26.10% have worked for 16-20 years while 17.40% have worked for 11-15 years.

In terms of the primary area of practice, many (65.20%) are into Radiography, 4.30% in Computed Tomography, and 21.70% have equal time in Radiography and CT. Since many of the respondents are licensed as X-ray technologists and worked as X-ray technicians, they are authorized to perform radiography. However, in Oriental Mindoro, they are also trained and allowed to use other modalities such as CT Scan. This is in contrary to Republic Act 7431, which states that the use of other modalities such as Computed Tomography, Ultrasonography, Mammography and others, must be done by a licensed radiologic technologist. Such practice is performed due to the limited number of licensed radiologic technologist.

In terms of the participation or attendance in continuing professional education, 39.10% of the respondents often participates in CPE, 26.10% sometimes attend while 13% seldom attend CPE. There were even those who never had CPE (8.70%). This is contradictory to CMO 18 s. 2006 in which the graduates of Bachelor of Science in Radiologic Technology and other Health Professions Education shall pursue continuing education in professional practice and management skills.

II. Quality Assurance Practices

A. Personal Skills of Radiologic Technologists Required for Examination

Table 2.1 presents the assessment of the personal skills of radiologic technologists required for examination which are classified as Patient Care and Management, and Quality Assurance Management.

The respondents assessed ten (10) of the fifteen (15) components under Patient Care and Management to have been always performed in “question female patients of childbearing age about possible pregnancy” and “explain breathing instructions before making the exposure”, both with 4.91 mean, in “confirms patient’s identity” with 4.87 mean, “observe patient after administration of contrast media to detect adverse reaction” and “document required information on patient’s medical record” both with 4.74.

The results show that many of the skills under Patient Care and Management are always performed by the respondents. These skills are important to protect the patients especially the childbearing women, from unnecessary radiation exposure and these practices are also requisites in producing quality diagnostic images. Bushong (2008) stated that the emphasis on radiation control in diagnostic radiology has shifted back to protection of the patient. Current studies suggest that even the low doses of x-radiation used in routine diagnostic procedures may result in a small incidence of latest harmful effects. It is also well established that the human fetus is sensitive to x-radiation early in pregnancy. Minimizing patient radiation dose without compromising image quality is an important issue in radiology today (Seeram and Brennan, 2006).

On the other hand, the other five components “explain patient preparation before an imaging procedure” with 4.48 mean, “recognize need for prompt medical attention and administer emergency care”, “provide for patient comfort and modesty”, “select immobilization devices when indicated, to prevent patient movement or ensure patient safety”, with 4.39 mean, and “observe and monitor vital signs” were only often performed by the respondents. This clearly shows that there are some personal skills which are not always performed. According to the respondents, the nurses are the ones in-charged in explaining the protocols to the patient and in obtaining the vital signs. However, as radiographers, they must also possess such skills. CHED (CMO 18 s. 2006) pointed out that the practice requires the knowledge necessary for the Radiologic Technologists to perform their tasks with confidence, effectiveness, and efficiency in patient care and management.

Under the Quality Assurance Management category, eight (8) of the eleven (11) components have been always carried out by the respondents in “position patient, x-ray tube, and image receptor to produce radiographs”, “use sterile or aseptic technique to prevent contamination of sterile trays, instruments, or fields”, “clean, disinfect, or sterilize facilities and equipment, and dispose of contaminated items in preparation for next examination” and “before administration of contrast agent, gather information to determine if the patient is at increased risk of adverse reaction” with 5.00, 4.70, 4.65, and 4.61 means respectively.

This shows that the respondents take much consideration in the correct positioning of the patients and x-ray tube. According to Sherer et al. (2011), retakes necessitated by mispositioning can still occur resulting in the possibility of a repeat examination that can cause additional radiation exposure for both the patient and the technologist. For this reason, care must be taken by the technologist to correctly position the patient and the equipment initially.

Nevertheless, there are three (3) components which were only often done in “follow appropriate procedures when in contact with a patient in reverse/protective isolation”, and “examine radiographic requisition to verify accuracy and completeness of information" both with 4.48 mean, and "prepare contrast media for administration" with 4.22. This implies that the respondents are not keen in handling patients in reverse/protective isolation and in the information given to them. Sherer et al. (2011) reveals that radiographers may be exposed to secondary or scattered radiation while fulfilling professional responsibilities associated with diagnostic imaging and the patients become sources of scattered radiation during diagnostic examination.

Collectively, the overall obtained mean is 4.57 with a verbal interpretation of always.

B. Clinical Skills of Radiologic Technologists

Table 2.2 shows the assessment of the clinical skills of radiologic technologists required for examination which are classified as pre-exposure (before examination), exposure (during examination) and post-exposure (after examination).

Of the fifteen (15) components listed under Pre-exposure (Before Examination), ten (10) aspects were always carried out by the respondents. These include "remove all radiopaque materials from patient or table that could interfere with the radiographic image", "set kilovolt peak level, milliamperage, and time or automated exposure system to achieve optimal image quality, safe operating conditions and minimum radiation dose', inspect and clean screens and cassettes", select equipment and accessories for the examination requested", and "perform basic evaluations of radiographic equipment and accessories" with 4.91, 4.87, 4.74 and 4.70 means respectively. Anyone using or operating X-ray equipment should be properly trained, and operators should know the biological hazards associated with its use (Jensen, 2007).

On the contrary, the five (5) components in "prepare and adjust radiographic imaging system and accessories", "recognize and report malfunctions in the radiographic imaging system and accessories", "recognize and report malfunctions in the automatic processor", "perform startup or shutdown procedures on automatic film processor" and "prepare and adjust the CT scan system and accessories" with the obtained means of 4.48, 4.13, 3.96, 3.83 and 3.22 respectively were often performed by the respondents. The respondents reveal that such skills are primarily performed by the chief radiologic technologist or the maintenance officer and that they are not fully trained to do such. Also, only two of the ten hospitals/clinics under study have CT scan machine. Thus, many respondents are not trained to handle CT scan. The skill for such obtained the lowest mean.

Table 2.1
Assessment on the Personal Skills of Radiologic Technologists Required for Examination (N = 23)

Items	Mean	Verbal Interpretation	Rank
A. Patient Care and Management			
1. Question female patients of childbearing age about possible pregnancy.	4.91	Always	1.5
2. Explain breathing instructions before making the exposure	4.91	Always	1.5
3. Confirms patient's identity.	4.87	Always	3
4. Observe patient after administration of contrast media to detect adverse reactions.	4.74	Always	4.5
5. Document required information on patient's medical record.	4.74	Always	4.5
6. Evaluate patient's ability to comply with positioning requirements for the requested examination.	4.70	Always	6
7. Position patient to demonstrate the desired anatomy using body landmarks	4.65	Always	7
8. Maintain confidentiality of patient information.	4.57	Always	8
9. Explain procedures to patient or patient's family.	4.52	Always	9.5
10. Use proper body mechanics or mechanical transfer devices when assisting patients.	4.52	Always	9.5
11. Explain patient preparation (e.g., diet restrictions, preparatory medications) before an imaging procedure.	4.48	Often	11
12. Recognize need for prompt medical attention and administer emergency care.	4.39	Often	13
13. Provide for patient comfort and modesty.	4.39	Often	13
14. Select immobilization devices, when indicated, to prevent patient movement or ensure patient safety.	4.39	Often	13
15. Observe and monitor vital signs.	3.74	Often	15
B. Quality Assurance Management			
16. Position patient, x-ray tube, and image receptor to produce radiographs.	5.00	Always	1
17. Use sterile or aseptic technique to prevent contamination of sterile trays, instruments, or fields.	4.70	Always	2
18. Clean, disinfect, or sterilize facilities and equipment, and dispose of contaminated items in preparation for next examination.	4.65	Always	3
19. Before administration of contrast agent, gather information to determine if the patient is at increased risk of adverse reaction.	4.61	Always	4
20. Monitor medical equipment attached to the patient (e.g. intravenous lines, oxygen) during the radiographic procedure.	4.57	Always	6
21. Properly sequence radiograph procedures to avoid residual contrast material affecting future examinations.	4.57	Always	6
22. Use universal precautions.	4.57	Always	6
23. Verify accuracy of patient film identification.	4.52	Always	8
24. Follow appropriate procedures when in contact with a patient in reverse/protective isolation.	4.48	Often	9.5
25. Examine radiographic requisition to verify accuracy and completeness of information.	4.48	Often	9.5
26. Prepare contrast media for administration.	4.22	Often	11
Composite Mean	**4.57**	**Always**	

Legend: 4.50 – 5.00 Always; 3.50 – 4.49 Often; 2.50 – 2.49 Sometimes; 1.50 – 2.49 Seldom; 1.00 – 1.49 Never

Table 2.2
Assessment on the Clinical Skills of Radiologic Technologists Required for Examination (N = 23)

Items	Mean	Verbal Interpretation	Rank
A. Pre-exposure (Before Examination)			
1. Remove all radiopaque materials from patient or table that could interfere with the radiographic image.	4.91	Always	1
2. Set kilovolt peak level, milliamperage, and time or automated exposure system to achieve optimal image quality, safe operating conditions, and minimum radiation dose.	4.87	Always	2
3. Inspect and clean screens and cassettes.	4.74	Always	3.5
4. Select equipment and accessories for the examination requested.	4.74	Always	3.5
5. Perform basic evaluations of radiographic equipment and accessories (e.g., lead aprons, collimator accuracy).	4.70	Always	5
6. Evaluate the need for and use of protective shielding.	4.61	Always	6
7. Take appropriate precautions to minimize occupational radiation exposure.	4.57	Always	7.5
8. Wear a personnel radiation monitoring device (film badge) while on duty.	4.57	Always	7.5
9. Warm up the x-ray tube according to manufacturer's recommendations.	4.52	Always	9.5
10. Evaluate patient and radiographs to determine if additional projections or positions should be recommended.	4.52	Always	9.5
11. Prepare and adjust radiographic imaging system and accessories.	4.48	Often	11
12. Recognize and report malfunctions in the radiographic or fluoroscopic imaging system and accessories.	4.13	Often	12
13. Recognize and report malfunctions in the automatic processor.	3.96	Often	13
14. Perform startup or shutdown procedures on automatic film processor.	3.83	Often	14
15. Prepare and adjust the CT scan system and accessories.	3.22	Often	15
B. Exposure (During Examination)			
16. Store film or cassette in a manner that will reduce the possibility of artifact production.	5.00	Always	1
17. Take appropriate precautions to minimize radiation exposure to patients.	4.96	Always	2.5
18. Select appropriate film of proper size and type.	4.96	Always	2.5
19. Use radiopaque markers to indicate anatomic side, position, or other relevant information.	4.83	Always	4
20. Restrict beam to limit exposure area, improve image quality, and reduce radiation dose.	4.78	Always	5
21. Prevent all unnecessary persons from remaining in area during x-ray exposure.	4.74	Always	6.5
22. Store film or cassettes in a manner that will reduce the possibility of artifact production.	4.74	Always	6.5
23. Select appropriate film-screen combination or grid.	4.61	Always	8
24. Modify exposure factors for circumstances such as involuntary motion, casts and splints, pathologic conditions, patient's inability to cooperate.	4.52	Always	9
25. Determine appropriate exposure factors using calipers, technique charts, and tube rating charts.	4.35	Often	10
C. Post-exposure (After Examination)			
26. Reload cassettes by selecting film of proper size and type.	4.91	Always	1
27. Determine corrective measures if radiograph is not of diagnostic quality and take appropriate action.	4.52	Always	2
28. Evaluate radiographs for diagnostic quality.	4.48	Often	3
29. Review and evaluate individual occupational exposure reports.	4.30	Often	4
30. Process exposed film.	4.22	Often	5
Composite Mean	**4.54**	**Always**	

Legend: 4.50 – 5.00 Always; 3.50 – 4.49 Often; 2.50 – 2.49 Sometimes; 1.50 – 2.49 Seldom; 1.00 – 1.49 Never

Noticeably, further scrutiny of Table 2.2 shows that nine (9) of the ten (10) components of the skills exhibited during exposure (examination) were always carried out. These are "store film or cassette in a manner that will reduce the possibility of artifact production" with the highest obtained mean of 5.00, "take appropriate precautions to minimize radiation exposure to patients" and "select appropriate film of proper size and type" both with 4.96 mean, "use radiopaque markers to indicate anatomic side, position, or other relevant information" with 4.83 mean, and "restrict beam to limit exposure area, improve image quality, and reduce radiation dose" with 4.78 mean. This is important since the American Society of Radiologic Technologists stated that accuracy is equally important during medical imaging exams that physicians rely upon for diagnosis. Furthermore, Sherer at al. (2011) emphasized that correct processing of radiographic mages leads to a decrease in the number of repeat examinations required, with a resultant reduction in exposure of the radiographer. They added that diagnostic imaging professionals have an ongoing responsibility to ensure radiation safety during all medical radiation procedures.

For the aspects under Post-exposure (after examination), two (2) of the five (5) aspects were rated always in "reload cassettes by selecting film of proper size and type with 4.91 mean, and "determine corrective measures if radiograph is not of diagnostic quality with 4.52 mean. Conversely, the three (3) aspects in "evaluate radiographs for diagnostic quality" with 4.48, "review and evaluate individual occupational exposure reports" with 4.30 mean, and "process exposed film", were only often performed by the respondents. The respondents revealed that in their workplaces, it is the physician who performs such skills. However, as radiographers they must be trained to perform such skills effectively. Interpretation of radiographs is an acquired skill that is perfected over time. By using the proper equipment and developing consistent evaluation processes, the interpreter will increase his or her probability of detecting defects (NDT Education Resource Center, 2001-2012).

Cumulatively, the overall obtained mean is 4.54 with a verbal interpretation of always.

Table 3.1
Relationship Between the Demographic Profile and the Assessment on the Personal Skills of Radiologic Technologists Required for Examination

Demographic Profile	Eta	p-value	Decision	Interpretation
Gender	0.204	0.655	Fail to Reject	Not Significant
Age	0.387	0.702	Fail to Reject	Not Significant
Civil Status	0.537	0.033	Rejected	Significant
Highest Educational Attainment	0.182	0.407	Fail to Reject	Not Significant
Licensed	0.204	0.655	Fail to Reject	Not Significant
Workplace	0.644	0.005	Rejected	Significant
Present Position	0.550	0.168	Fail to Reject	Not Significant
Number of Years in Professional Practice	0.432	0.418	Fail to Reject	Not Significant
Primary Area of Practice	0.422	0.445	Fail to Reject	Not Significant
Participation/Attendance to Continuing Professional Education	0.388	0.700	Fail to Reject	Not Significant

Legend: Significant at p-value < 0.05;

III. Relationship Between the Demographic Profile and the Assessment on the Personal Skills of Radiologic Technologists Required for Examination

As seen from Table 3.1, the computed eta values of civil status (0.537), and workplace (0.644) indicate moderate positive association and the resulted p-values were less than 0.05 level of significance, therefore the null hypothesis of no significant relationship between the demographic profile (civil status and workplace) and the assessment on personal skills required for examination is rejected. This implies that the respondents' assessment on personal skills required for examination is affected by their civil status and place of work. The results are similar to the study of Reagan and Slechta (2010) which showed the weak, positive relationship between primary worksite and personnel safety practices. It also revealed that no significant relationships were found between initial education and compliance or highest education and compliance.

Other variables do not show significant relationship and indicates that the personal skills of radiologic technologists required for examination do not depend on their gender, age, highest education attainment, holder of professional license, present position, primary area of practice, number of years in professional practice and participation/attendance to continuing professional education. This is also supported by the findings of Reagan and Slechta (2010) that there are no significant relationships between initial education and compliance or highest education and compliance. On the other hand, the findings on the effect of years in practice is contradicted by Reagan and Slechta's study in 2010 which revealed that the compliance with safety practices declined with years in practice and the decline in the mean compliance score was greater for personnel safety than for patient safety.

Table 3.2
Relationship Between the Demographic Profile and the Assessment on the Clinical Skills of Radiologic Technologists Required for Examination

Demographic Profile	Eta	p-value	Decision	Interpretation
Gender	0.103	0.899	Fail to Reject	Not Significant
Age	0.312	0.864	Fail to Reject	Not Significant
Civil Status	0.407	0.164	Fail to Reject	Not Significant
Highest Educational Attainment	0.010	0.965	Fail to Reject	Not Significant
Licensed	0.305	0.376	Fail to Reject	Not Significant
Workplace	0.297	0.398	Fail to Reject	Not Significant
Present Position	0.410	0.508	Fail to Reject	Not Significant
Number of Years in Professional Practice	0.327	0.709	Fail to Reject	Not Significant
Primary Area of Practice	0.508	0.226	Fail to Reject	Not Significant
Participation/Attendance to Continuing Professional Education	0.628	0.100	Fail to Reject	Not Significant

Legend: Significant at p-value < 0.05;

IV. Relationship Between the Demographic Profile and the Assessment on the Clinical Skills of Radiologic Technologists Required for Examination

As shown in Table 3.2, all computed eta values indicates moderate positive correlation but the computed p-values were all greater than 0.05 level of significance; thus, the researchers fail to reject the null hypothesis of no significant relationship between the demographic profile of the respondents and their assessment on clinical skills of radiologic technologists required for examination. This means that the respondents' assessment on the clinical skills is not affected by their demographic profile.According to Bushong (2008), as one progress training in radiologic technology, one will quickly learn how to operate the x-ray imaging systems safely, with minimal radiation, exposures, by following standard protection procedures. Nevertheless, Colangelo et al. (2009) pointed out that the radiologic technologists must know the importance of understanding and implementing such practices to ensure optimal patient and technologist safety. This implies that proper training is important to develop the clinical skills required for radiologic technologists.

CONCLUSION

Most of the quality assurance practices in terms of personal and clinical skills are always performed by the respondents. However, there are aspects particularly in patient care and management under personal skills and before and after examination under clinical skills, that were only performed often. More so, the civil status and the workplace significantly affect their personal skills. On the other hand, the clinical skills of the radiologic technologists required for examination is not affected by their demographic profile.

RECOMMENDATIONS

It is recommended that the identified quality assurance practices in terms of the personal and clinical skills of radiologic technologists, which were rated often be improved. It is also recommended to continuously assess the compliance of the staff in the diagnostic imaging departments to ensure safety among the patients and the staff of the diagnostic imaging departments. Periodic exposure audits can also be performed among the personnel.

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