JMBR: A Peer-review Journal of Biomedical Sciences
June 2017, Vol. 16 No. 1 pp 62-67

RESPONDENTS ASSESSMENT OF OPERATIONAL STATUS OF X-RAY MACHINES IN BENIN CITY, NIGERIA.

Eze .E [1] AND Adams O.H.[2]

ABSTRACT

This cross sectional descriptive study was conducted to evaluate the status of x-ray machine in Benin City. Questionnaires were distributed and analysed using descriptive statistics. The results show that 82.6% of the x-ray machines were fixed and17.4% mobile. 91.3% were conventional x-ray machines, only 21.7% usedcomputedradiography. 30.4% of respondents had no idea about their x-ray equipment manufacture date. Installation dates given, show all x-ray machines were installed under 12 years ago.82.6% of respondents had equipment servicing agents while 13% had none. 26.1% of respondents gave a specific machine servicing schedule for their facilities.39.1% of respondents had a designated Radiation Safety Officer (RSO)at their facility. 47.8% had none.39.1% of respondents reported that they had Medical Physicists attached to their facility, 56.5% reported that they did not. The result of the study indicated that most of the x-ray machines used in radiological facilities in the city, were not under safety control.

INTRODUCTION

The evolutional trend of radiography from conventional to computed, is a laudable development in the radiography practice however, many centers within the country still practice conventional radiography, which appears to be old-fashioned in developed countries today. The need for facilities to upgrade from conventional to digital is hinged on the benefits of dose reduction, high image quality and better image storage over conventional radiography which is still saddled with the rigors of poor image quality, chances of repeat exposures and hazards of film processing chemicals. Many of the radiological centers in the country, just as it is in many third world countries, still operate very old, near obsolete X-ray machines[1].There are almost no measures of routine maintenance checks and recalibration after servicing to ensure optimal equipment performance. Regrettably, equipment Quality Assurance (QA) programmes are barely practiced, in the country, as a number of studies have demonstrated[1,2,3]. However, there is also the challenge of scarcity of Medical Physicists and Radiation Safety Officers (RSO) whose responsibility it is to establish QA programmes that will ensure optimum performance of x-ray machines and maximize patient safety.

The American Association of Physicist in Medicine (AAPM) asserts that the absence of QA programmes in radiological departments could cause equipment over-

KEYWORDS: x-ray machine, radiological facility,Quality Assurance.

Eze .E [1]
Department of Radiography and Radiation Science,University of Benin, Benin City, Nigeria. Phone number 08068562225
Email: ejiro.eze@uniben.edu

Adams O.H.[2]
Department of Radiography and Radiation Science, University of Benin,Benin City, Nigeria.

**Correspondence*

exertion and malfunction, which may ultimately result in equipment breakdown[4]. Ngoyeet al.[5] further advocate the presence and implementation of QA programmes, as they would facilitate early detection of equipment malfunction which if missed, may result in higher patient doses and reduced image quality.

This study therefore, was aimedat evaluating the state of x-ray equipment in radiological facilities in Benin City.

MATERIALS AND METHODS

The study design was a cross sectional study of radiographers working in radiological facilities in Benin City, Nigeria. A four sectioned questionnaire survey (adapted from the Pre-Assessment Questionnaire, Diagnostic Imaging Facility by the College of Physicians and Surgeons of Ontario, 2012), was distributed to 28 radiographers randomly selected from radiological facilities in Benin city. The questionnaire was designed to obtain information on demographics, facility, equipment information and equipment QA. Data was analyzed using descriptive statistics and a response rate of 82%, 23 radiographers was obtained. Informed consent was obtained from all participants.

RESULTS

Respondents Characteristics

Out of the 28 radiographers, 39.1% and 60.9% were males and females respectively. The mean age of respondents was 31.2 years, with 52.2 % aged between 20 and 29 years while 47.8% were above 29 years. Majority of respondents graduated one year ago and 4.3% graduated 25 years ago however, the mean number of years since graduation was 4.96 years.

82.6% of respondents had a Bachelors Certificate in Radiography while 17.4% had diplomas. 57.9% of the Bachelors certificate holders, preferred to be addressed as Medical Imaging Scientists, rather than as Radiographers.

Facility

All respondents reported that they had patient-waiting rooms, procedure rooms and image processing rooms. 8.7 % had neither image storage rooms nor facility storage rooms in their facility, however 2 other respondents who apparently had no image storage room, reported that they had a facility storage room which also served as the image storage room. 17.4% had no dedicated changing room and explained that their procedure room doubled as their changing room.

Describing their place of employment, 78.3% responded that they were employed in hospitals, and 21.7% were employed in diagnostic centres. Of these, 22.2% of hospitals were privately owned while 77.8% were government owned. All the diagnostic centres were privately owned. The number of patients attended to per week, by respondents, ranged from 15 to 210, with a mean of 83 patients. The number of radiographers at each facility ranged from 1 to 14 with an average of 6 radiographers per facility.

Radiography Equipment

All respondents reported that they had X-ray machines at their facility. 82.6% of the x-ray machines were fixed while 17.4% were mobile (Table 1). Most x-ray machines used by therespondents were conventional x-ray machines (91.3%). 65.2% reported that they had both Computed Tomography and x-ray machines. 56.5% had fluoroscopy machines and 47.8% had mammography machines.Only 21.7% reported that they

LIST OF TABLES

Table 1: Types of x-ray unit and record keeping device.

Type of x-ray unit	
Fixed	82.6%
Mobile	17.4%
Image/record keeping device	
Conventional film screen	91.3%
Computerized Radiography	21.7%

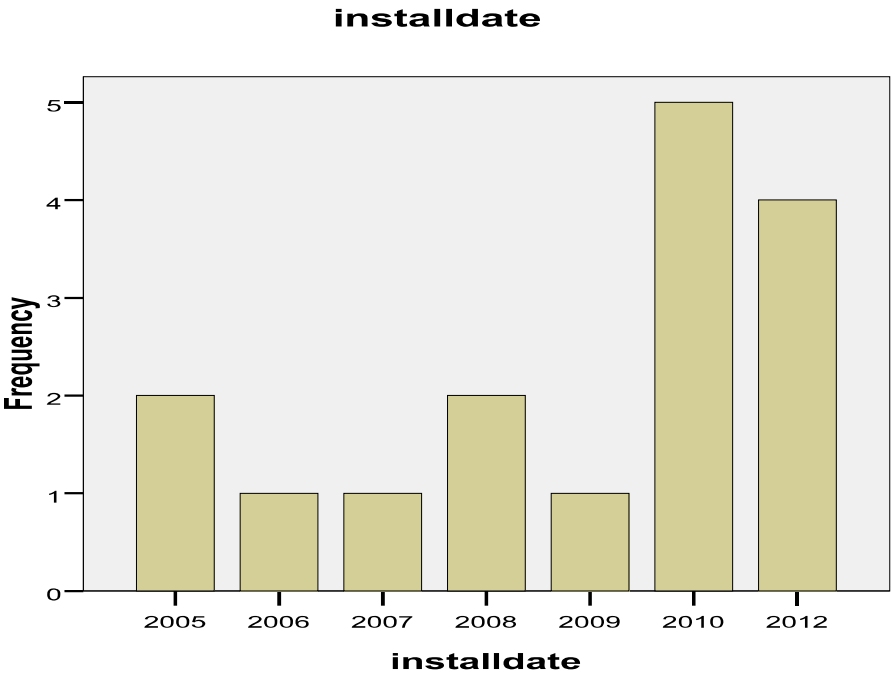

Figure 1: Barchart showing Installation dates of x-ray machine

Table 2: Equipment information and QA programme

	Yes	No	Unsure
Manufacture date	69.6%	30.4%	-
Installation date	100%	-	-
Equipment servicing agent	82.6%	13%	4.3%
Servicing schedule	21.6%	73.9%	-
RSO	31.9%	47.8%	13%
MP	39.1%	56.5%	4.3%

had computed radiography systems in use at their facilities. No Direct Digital Radiography or PACS System was reported to be used by any respondent.

30.4% of respondents had no idea about their x-ray equipment manufacture date (Table 2). From the installation dates given by respondents, all x-ray machines in use, were installed under 12 years (with the oldest machines being installed 11 years ago).

Equipment information and Quality Assurance Programme

Only 82.6% of respondents had equipment servicing agents attached to their facilities where they worked, while 4.3% had no idea if there were any equipment servicing agents attached to their facility(Table 2). Only 26.1% of respondents could give a specific machine servicing schedule for their facilities. The remaining 73.9% of respondents, could not give specific intervals for equipment servicing, but rather reported that servicing was done when the machine broke down and was repaired.39.1% of respondents had a designated RSO at their facility, 47.8% did not and 13% were unsure if their facility had a designated RSO. In addition, 39.1% of respondents reported that they had Medical Physicists attached to their facility, 56.5% reported that they did not and 4.3 % were unsure if they had a medical physicist attached to their facility.

DISCUSSION

Conventional X-ray Machines Vs Computed Radiography X- ray

While the widespread use of film-screen systems and auto processors could be commended, the use of digital radiography is still advocated as it would provide lower exposure doses to patients and personnel as well as eliminate the hazards of working with film processing chemicals. Computed radiography has

also been identified as a good means of dose reduction based on the available option of image manipulation after capture, image duplication and storage compaction[6], thus reducing the need for repeat exposures. Unfortunately however, only 21.7% of respondents utilized computed radiography systems at their facilities and no Direct Digital Radiography or PACS System was reported to be in use at any facility. This seems to be a common pattern in other parts of the country[1].

X-Ray Machine Status

To ensure proficiency in X-ray machine performance, the machines should be in proper working condition. This can only be achieved through regular servicing and maintenance of the machine, and encouragingly, most diagnostic facilities had attached equipment servicing agents (Table 2). Common to most facilities was the absence of a maintenance schedule as only 26.1% of respondents could give a machine servicing schedule for their facilities. Many respondents, reported that servicing was done when the machine broke down and was repaired. Similarly, Oforiet al. [7]also reported that machine repairers were contacted only when there was machine malfunction, but no stipulated arrangement for routine maintenance existed. This practice may expose radiographers and patients to harmful ionizing radiationlong before the breakdown of machines.

The observed trend is that a lot of the X-ray machines in the country are old, with operators not being aware of the actual age of these machines. Michael et al. [8] reported a similar trend where radiographers could not account for manufacture/installation dates of machine as they were no operational or circuit manuals. It was also observed that respondents were reluctant todisclosewhether the machines were purchased new or used. The reported installation dates showed the oldest machines to be about 11 years old (figure.1) andas such were not yet due for replacement. This is similar to the study by Michael et al. [8] who reported that machines in the facilities investigated, were 3 to 11 years old, but discovered that most of the machines referred to as new were actually refurbished.Another study by Koriret al. [9] also reportedthat the best-working equipment was 2 years old and worst working machine was 25yrs old. All of these allude to the fact that the functionality of the machine is linked to its age.

The Role of RSO/MP in Radiological Equipment QA Practice

The implementation of QA programme in the facilities investigated was not all encompassing as only 39.1% of respondents had a designated Medical Physicist and RSO, while the others did not have any in place to develop and implement QA programme. De Stefano [10] further identifies QA as the job of the Medical physicist and this view is also shared by the AAPM who outline that the development and supervision of a QA programme, is the duty of a Medical Physicist. [4] This appears not to be the popular practice in Benin however, as less than 40% of respondents reportedly had Medical Physicists attached to their facility. Oluwafisoyeet al. [2] reported the absence of Medical Physicist in a facility that was experiencing high radiation leakage. With the absence of Medical Physicists and RSO in radiological departments, attempts at QA activities are left to the radiologists, radiographers and other radiation workers, who in actual fact do not possess sufficient knowledge or skillsto carry out these activities.

The lack of clearly outlined and routinely applied QA programs and machine servicing practices may also be responsible for the frequent radiological equipment breakdown and malfunction experienced in the region. Similar patterns were observed in studies done in other Nigerian towns like Calabar[3] as well as other African countries like Tanzaniaand Ghana [5][7] where it was observed that QA programmes were either non-existent or not adhered to in radiological facilities.

CONCLUSION

This study shows that most of the x-ray machines in Benin City are not under safety control and may become sources of inadvertent unnecessary radiation exposure.

The benefits of diagnostic x-rays are reduced when machines are operated without adequate QA and maintenance, thereby posing high risk of radiation exposure.

Total upgrading that will encompass the transition from old conventional to computed radiography, development and implementation of workable quality assurance programmes and continuous development programmes for radiographers are the way forward.

A limitation of this study is the small sample size which was as a result of the inaccessibility of some radiographers, being restricted from participating in the study, by the authorities of their facility.

REFERENCES

1. Eze CU, Abonyi LC, Njoku J, Irurhe NK. Assessment of radiation protection practices among radiographers in lagos,Nigeria. Nigerian Medical Journal (2013); 54(6); 386-391.

2. Oluwafisoye PA, Olowookere CJ, Oluwagbemi MA, Adeola OF. Monitoring and Quality Control Tests of Nigerian National Petroleum Corporation (NNPC) Diagnostic Facilities. Journal of Theoretical & Applied Information Technology. (2009); 5(3); 286-294.

3. Inyang SO, Egbe NO, Inyang IS, Oshi DO. Baseline Survey of Level of Quality Control in Medical Radiology in Cross River State Nigeria. Polish Journal of Medical Physics and Engineering. (2010); 16(2); 97-106.

4. American Association of Physicists in Medicine. Quality Control in Diagnostic Radiology Report (2002);74

5. Ngoye WM, Motto JA, Muhogora WE.Quality Control Measures in Tanzania: Is it done? Journal of Medical Imaging and Radiation Sciences (2015);46(3); 23-30.

6. Davies C, Grange S, Trevor MM. Radiation Protection Practices and Related Continuing Professional Education in Dental Radiography: A survey of practitioners in the north-east of England. Radiography.(2005); 11; 255-261.

7. Ofori EK, Antwi WK, Scutt DN. Current Status of Quality Assurance in Diagnostic Imaging Departments in Ghana. The South African Radiographer. (2013);51(2); 19-25.

8. Michael OA,Akintayo DO, Kofoworola OS, Samuel OA, Moses AA, Helen BA. Assessment of Peak Kilovoltage Accuracy in Ten Selected X-ray Centers in Lagos Metropolis, South-Western Nigeria. A Quality Control Test to Determine Energy Output Accuracy of an X-ray Generator. Journal of Health Research and Reviews (2016); 3(2); 60-65.

9. Korir GK, Wambani JS, Korir IK. Establishing a quality assurance baseline for radiological protection of patients undergoing diagnostic radiology. South Africa Journal of Radiology.2011; 15(3); 70-79.

10. De Stefano A. Two techniques to facilitate quality assurances procedures on medical imaging. Medical Physics International Journal. (2013);1(1); 56-59.