Middle-East Journal of Scientific Research 27 (5): 393-399, 2019
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2019.393.399

Personnel Radiation Monitoring among Practising Radiographers in Radio-Diagnostic Centers in Anambra State

C. Ugwuanyi Daniel, C. Eze Joseph and O. Okpala Sampson

Department of Medical Radiography and Radiological Sciences,
Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria

Abstract: The use of ionizing radiation in the health sector is of tremendous diagnostic and therapeutic benefit to patients. The diagnostic role of x-rays in medicine is well established since its discovery in 1895. Despite wide applications of ionizing radiation in contemporary medicine, it can be hazardous if not properly handled. This study was carried out to evaluate personnel radiation monitoring among practicing radiographers in radio-diagnostic centers in Anambra State. A cross sectional prospective survey that targeted radiographers working in six selected private and government owned hospital/radio-diagnostic centers in Anambra State was conducted. The data collection instrument was a twenty four-item semi-structured self-completion questionnaire. Personnel radiation monitoring was available in only 1 out of the 6 hospitals/radio-diagnostic centers (16.7%) and radiation monitoring does not cover all the radiographers on employment currently. Radiation monitors were found not to be read regularly at about every quarter of the year and it takes more than 3 years for fresh supplies of radiation monitoring devices to be made in the hospital where radiation monitoring is carried out. Radiation protection advisers or supervisors were not available in the hospitals/radio-diagnostic centers under study. Majority of the radiographers (53.3%; n = 16) believe the hospital/center management do not make provision for it in their budget. Dosimetric records of staff are not given any consideration during recruitment of new staff. The examination of the knowledge of radiographers showed that most of them do not have a good knowledge of the average annual permissible dose limit for radiation workers. Personnel radiation monitoring in Anambra State is abysmally poor. This is a significant precautionary lapse as radiation risks cannot be assessed and corrective measures taken.

Key words: Personnel Radiation Monitoring · Radiation Protection Advisers · Practising Radiographers and Radio-Diagnostic Centers In Anambra State

INTRODUCTION

The use of ionizing radiation in the health sector is of tremendous diagnostic and therapeutic benefit to patients [1]. The diagnostic role of x-rays in medicine is well established since its discovery in 1895 [2]. Despite wide applications of ionizing radiation in contemporary medicine, it can be hazardous if not properly handled [3]. Unbridled exposure to ionising radiation had been scientifically proved to cause damages to living tissue such as skin burn, cataract and radiation sickness at high exposures (Deterministic effects) and also raises the risks of tumours, infertility and genetic damages (Stochastic effects) at low exposures [4].

The annual per capita effective dose has doubled over the past decade worldwide due to the daily increase in the use of radiation for both diagnostic and therapeutic purposes [1]. This implies that more people are exposed to ionizing radiation.

Due to the detrimental effects of ionizing radiation, it is necessary to keep all radiation exposures and hence radiation dose to personnel and patients as low as reasonably achievable (ALARA) or practicable (ALARP) [5].

It is clearly sensible for those involved in use of ionizing radiation in diagnostic radiology to have an appreciation of the possible risks involved [6]. For radiographers, measurement of radiation doses received

Correspondent Author: Daniel Chimuanya Ugwuanyi, Department of Medical Radiography and Radiological Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.
Tel: +2348033971062.

at periodic intervals represents a way of monitoring doses to ensure that they are within safe occupational limits. Monitoring of radiation doses received by staff in radio-diagnostic centers is of great importance to the radiographers [7].

Personnel radiation monitoring is essential to ensure that dose limits for staff is not exceeded [2]. The dose limits for staff as reported by the International Commission on Radiological Protection (ICRP) in 1977 was 50milisievert (mSv), public should not be exposed to more than an average of 1mSv per year [8]. A downward review was done in 1991 and an effective annual dose limit of 20mSv was adopted as an average for a period of five years, with the further provision that the effective dose should not exceed 50mSv in any single year [9].

Film badges, thermoluminiscent dosimeters and pocket ionizing dosimeters are the recommended radiation measuring devices for use by exposed radiation workers to monitor received radiation dose [5]. Every worker is expected to wear his personal dosimeter always while working [5]. The dosimeter readings are kept as records for every staff for the purpose of evaluating their radiation history and possible risks involved. The radiation records help in improving radiation protection practices in clinical settings [3]. Anambra state is not exempted from the ever increasing use of ionizing radiation and there is little or no available data in the state on the regularity of use of personnel dosimeters by radiographers and the status of monitoring as required by established standards [10]. Hence, this research aims at evaluating and assessing personnel radiation monitoring practices among radiographers in both private and public diagnostic radiology centres in Anambra State.

Objectives:

- To assess the knowledge and practice of personnel radiation monitoring among practising radiographers in radio-diagnostic centres in Anambra State.
- To assess the provisions and the routine use of personnel radiation monitoring devices among radiographers in Anambra State.
- To ascertain the adequacy and challenges of this practice in the departments under study.
- To find out the types of devices being used in the state.
- To establish the availability of dosimetric records of workers.

MATERIALS AND METHODS

Research Design: This study employed a cross-sectional prospective survey.

Location of Study: This study was conducted in both private and government owned Radio-diagnostic centres in Anambra state, Nigeria.

Target Population: The target population were diagnostic radiographers in selected private and government owned radio-diagnostic centres in the study locality.

Sample Size: A non-probability sampling method also known as convenience sampling method was used in selecting participants of study.

Sources of Data Collection: The source of data was questionnaire. A 24-item semi-structured self completion questionnaire was used for the study. The questionnaire was designed according to the objective of the study.

Procedure for Data Collection: The questionnaires were distributed by the researcher. He gave them out individually to the respondents in the radiology departments of the hospitals/centres that were selected. Some respondents filled and handed them over to him immediately while some were later collected on appointment.

Data Analysis: A total of 35 questionnaires were distributed and 30 were duly filed out and collected by the researcher during the period of data collection, giving a response rate of 85.7%.

The data collected from the questionnaire were analysed using statistical package for social science (SPSS) version 21.0 and presented using descriptive statistics.

RESULTS

Data Presentation: The analysed data were described and presented using tables as shown below:

Bio Data and Work Related Information of Respondents: Most of the respondents (63.3%) were aged 20-29 years while the rest (36.7%) were aged 30-39 years. The population of respondents were equally divided as there

Table 1: Bio data and work related information of respondents

Variable	Frequency	Percent
Age range		
20-29	19	63.3
30-39	11	36.7
Total	30	100.0
Sex		
Male	15	50.0
Female	15	50.0
Total	30	100.0
Academic qualification		
BSc	27	90.0
Masters	3	10.0
Total	30	100.0
Name of hospital or diagnostic centre		
NAUTH	18	60.0
COOUTH	1	3.3
SUN DIAGNOSTIC	3	10.0
ONITSHA MEDICAL	3	10.0
IYIENU MISSION HOSPITAL	4	13.3
ST CHARLES DIAGNOSTIC	1	3.3
Total	30	100.0
Type of modalities often worked with in the department.		
X- ray	7	23.3
X-ray and CT	3	10.0
X-ray and Mammography	1	3.3
X-ray, CT and Fluoroscopy	10	33.3
X-ray, CT and Mammography	9	30.0
How long have they worked in their departments?		
Less Than One Year	19	63.3
1-5 Years	8	26.7
6-10 Years	3	10.0

were 15 males and 15 females. Master degree holders accounted for 10% (3) of the respondents while BSc holders accounted for 90% (27) of the respondents. Majority of the respondents 18 (60%) worked with NAUTH, followed by those working in Iyienu Mission Hospital 4 (13.3%), Sun Diagnostic 3 (10%), Onitsha Medical Diagnostics 3 (10%), COOUTH 1 (3.3%) and St Charles Diagnostic 1 (3.3%).

Majority of the respondents worked with X-ray, CT and Mammography 10 (33.3%) while minority of the respondents worked with X-ray and Mammography only 1 (3.3%). Nineteen (63.3%) of the respondents had worked in their department for less than one year and only 3 (10%) had worked for 6-10 years. Most of them 13 (43.3%) worked for more than 6 hours while only one person (3.3%) worked for less than 3 hours.

Radiation Protection and Personnel Monitoring Awareness: Most of the respondents 26 (86.7%) agreed to having radiation protection devices in their department but only 6 (20%) of them felt the radiation protection in their department was adequate. Only 7 (23.3%) of the respondents agreed to knowing the average annual permissible dose limit for radiation workers according to international commission on radiological protection and out of them, only 3 (10%) of them gave the right answer (20 Msv). Majority 18 (60%) of them felt they received higher occupational radiation exposure than necessary.

Personnel Radiation Monitoring Information: Very few 2 (6.7%) were agreed to the provision of any personnel monitoring device currently. The device provided for the two was Themoluminecence Dosimeter, however, they only used the devices sometimes and their monitoring device was taken for reading above 3 months. Three (10%) of the respondents had been provided with radiation monitoring device before but were not currently receiving such provision. For some respondents 5 (16.7%), the provision of personnel radiation monitoring devices had stopped above 3 years while for others it had stopped for up to 1-2 years 2 (6.7%) and 2-3 years 2 (16.7%) respectively. The most common reason for

Table 2: Radiation Protection and Personnel Monitoring Awareness

Variable	Frequency	Percent
How many hours they worked in the diagnostic room per day?		
Less Than 3 Hrs	1	3.3
3-4 Hrs	6	20.0
4-6 Hrs	10	33.3
More Than 6 Hrs	13	43.3
Do you have radiation protection devices in your department?		
Yes	26	86.7
No	3	10.0
Total	29	96.7
Missing System	1	3.3
If yes, do you think the radiation protection in your department is adequate?		
No Response	5	16.7
Yes	6	20.0
No	18	60.0
Total	29	96.7
Missing System	1	3.3
Do you know the average annual permissible dose limit for radiation workers according to international commission on radiological protection?		
No Response	9	30.0
Yes	7	23.3
No	14	46.7
Total	30	100.0
What is the average annual permissible dose limit for radiation workers according to international commission on radiological protection?		
No Response	25	83.3
0.1 Msv	1	3.3
1 Msv	1	3.3
20 Msv	3	10.0
Total	30	100.0
Considering the time you spend in the diagnostic room per day, do you think you receive occupational radiation exposure higher than necessary?		
No Response	2	6.7
Yes	18	60.0
No	10	33.3
Total	30	100.0

non-provision of the device was that the management does not care 16 (53.3%). Majority 13 (43.3%) of the respondents agreed that there had been complaint to the management and the major reason given by the management for not providing the devices was lack of fund 4 (13.3%). Among those who did not complain, only one person identified non-challant attitude as the reason for not complaining about the non-provision of the devices. Seventeen (56.7%) of the respondents had worked with other hospital/centers and 9 (53%) of them had been provided with monitoring devices in their previous workplaces. Majority 28 (93.3%) of the respondents reported that their present workplace did not demand for their Dosimetric monitoring record before employing them. Majority 25 (83.3%) of the respondents disagreed to having any radiation protection adviser or departmental radiation protection supervisor in their department. The most common suggestions made by the respondents to improve radiation monitoring in the department included: request for and frequent use of devices by radiographers 11 (36.7%); ensuring annual quality assurance 6 (20%); employment of radiation safety officers/advisers 3 (10%) and demanding of devices by employees on appointment 3 (10%).

Amongst all the six diagnostic centres/hospitals, only Iyienu mission hospital had monitoring devices for personnel which do not cover all radiographers on employment currently.

Table 3: Personnel Radiation Monitoring Information

Variable	Frequency	Percent
Are you provided with any personnel monitoring device currently?		
Yes	2	6.7
No	28	93.3
Total	30	100.0
If yes, what type of personnel radiation monitoring device		
No Response	28	93.3
Thermoluminecence Dosimeter	2	6.7
Total	30	100.0
How often do you wear personnel radiation monitoring devices while working?		
No Response	28	93.3
Sometimes	2	6.7
Total	30	100.0
How often is your monitoring device taken for reading?		
No Response	28	93.3
Above 3 Months	2	6.7
Total	30	100.0
If no personnel radiation monitoring device currently, were you provided with one before?		
No Response	6	20.0
Yes	3	10.0
No	21	70.0
Total	30	100.0
For how long has the provision of personnel radiation monitoring device been stopped?		
No Response	21	70.0
1-2 Years	2	6.7
2-3 Years	2	6.7
Above 3 Years	5	16.7
Total	30	100.0
What is the reason for non provision of the device?		
No Response	4	13.3
No Radiation Safety Officer To Provide The Service	1	3.3
Lack Of Fund For The Exercise	3	10.0
Radiographers Do Not Request For It	1	3.3
Management Do Not Care	16	53.3
Others	5	16.7
Total	30	100.0

Table 4: Are You Provided With Any Personnel Monitoring Device Currently?

Name of Hospital or Diagnostic Centre			Frequency	Percent	Valid Percent	Cumulative Percent
Nauth	Valid	NO	18	100.0	100.0	100.0
Coouth	Valid	NO	1	100.0	100.0	100.0
Sun Diagnostic	Valid	NO	3	100.0	100.0	100.0
Onitsha Medical	Valid	NO	3	100.0	100.0	100.0
Iyienu Mission Hospital	Valid	YES	2	50.0	50.0	50.0
		NO	2	50.0	50.0	100.0
		Total	4	100.0	100.0	
St Charles Diagnostic	Valid	NO	1	100.0	100.0	100.0

DISCUSSION

The bio data of the respondents shows that more young individuals are getting into the radiography profession which is very commendable. Also, it is worthy of note that the profession is gender sensitive as both males and females are well represented in the profession as can be seen from this work. However, very few of the respondents possessed higher than BSc. This indicates that there is the need to encourage young professionals to pursue higher academic qualifications despite their passion for practice, which is common. It was found that Fluoroscopy is the least common device as only NAUTH workers had worked with it often. Also,

Mammography was not common as both NAUTH and COOUTH workers did not use it often. The fact that majority of the respondents had worked for less than one year could be a reason for the non-provision of monitoring device by various centers.

The report of most of the respondents staying as high as 6 hours in the diagnostic room per day calls for attention as this could possibly be an indication of high exposure as agreed to by 18 (60%) of the respondents. It is commendable that as many as 26 persons reported having radiation protection devices in their department. However, only 6 of them agreed to the adequacy of the devices provided. It is sad to note that very few 3 (10%) of the respondents knew the average annual dose limit for radiation workers according to international commission on radiological protection.

Information on the current status of the various hospitals/centers showed that only 2 workers were currently provided with personnel monitoring devices (Themoluminecence Dosimeter) in one out of the six hospitals/centers investigated. This is a pitiable condition indeed. Worst still is the fact that the two workers having this provision only use it sometimes, indicating that they do not value the role of the device in keeping them safe. This is similar to the finding of Okaro *et al.* [6] in which only 4 out of 10 governments owned hospitals studied had personnel radiation monitoring devices. It is also in line with the study of Eze *et al*. [11] in which only two out of ten publicly owned centres had personnel and environmental monitoring. It is however contrary to the finding of Adejumo *et al.* [3] in which high compliance and monitoring in diagnostic centres in the south west was reported. Their responses also showed that it took more than three months for the monitoring devices to be taken for reading. This is beyond the recommended quarterly reading. Three of the respondents had been provided with monitoring devices before but for more than three years the provision had stopped for 5 persons. The responses of the workers indicates that despite complaints made the management of the various centres did not care enough to make necessary moves to remedy the situation, pointing to lack of fund as the major reason for their lack of action. However, the fact that the previous work places of the respondents made these provisions proves that not all hospitals/centers are guilty of non-provision of protection and monitoring devices. It can be seen from the responses that the employers of the respondents failed to demand for their dosimetric monitoring record, perhaps due to the fact that they were not going to maintain such records in their own centres. With only 5 persons agreeing to have a radiation protection adviser/supervisor, the need for such personnel in the various centres examined in this work becomes immediately evident. However, it remains the role of the management of the various centers to employ such personnel. The suggestions made points to the role of the individual employee in requesting for and using the needed devices as well as the need for annual quality assurance.

CONCLUSION

After careful evaluation of the evidences presented in this study, the researchers concluded that:

- Most Radiographers were exposed to unsafe working conditions.
- Most of the hospitals/diagnostic centers are not keenly interested in the safety of their workers.
- The provision and use of personnel monitoring devices is abysmally poor and this is a significant precautionary lapse as radiation risks cannot be assessed and corrective measures taken.

REFERENCES

1. Botwe, B., W. Antwi, K. Adesi and S. Anim-sampong, 2015. Personal Radiation Monitoring of Occupationally Exposed Radiographers in Biggest Tertiary Referral Hospital in Ghana. Safety in Health, (Online), 17(1): 1. Available at: http://www. biomedcentral.com (Accessed 20 May, 2018).
2. Samer, A., 2014. Ionizing Radiation Leakage and Radiation Protection Measures in Radio-diagnostic Centres in Governmental Hospitals of Gaza Governorate, Palestine. Gaza: Islamic University Gaza
3. Adejumo, S., N. Irurhe, O. Olowoyeye, A. Ibitoye, C. Eze and O. Omiyi, 2012. Evaluation of Compliance to Radiation Safety Standard Amongst Radiographers in Radio-diagnostic Centres in South West Nigeria. World Journal of Medical Sciences, 7(3): 194-196.
4. Eze, C., L. Abonyi, J. Njoku, N. Irurhe and O. Olowu, 2013. Assessment of Radiation Protection Practices Among Radiographers in Lagos, Nigeria. Nigerian Medical Journal, 54(6): 386-391.
5. Nwokeoji, I. and G. Avwiri, 2017. Evaluation of Personnel Radiation Monitoring in Selected Hospitals in South-South and South-East Region of Nigeria. Journal of Scientic Research and Report, 17(4): 1-6.

6. Okaro, A., C. Ohagwu and J. Njoku, 2010. Evaluation of Personnel Radiation Monitoring in Radio-diagnostic centres in South Eastern Nigeria. African Journal of Basic and Applied Sciences, 2(1-2): 49-53.
7. Ugwu, A., 2014. Assessment of the Level of Practice of Personnel Radiation Monitoring in Diagnostic Radiology Centres in Lagos State. (Online) Afribary. Available at: http://www.afribary.com (Accessed 20 May, 2018).
8. International Atomic Energy Agency, 2004. Individual Monitoring; Practical Radiation Technical Manual, (Online), pp: 15-23. Available at: http://www.iaea.org (Accessed 19 may, 2018).
9. International Commission on Radiological Protection, 1990. The Recommendations of the International Commission on Radiological Protection (ICRP); Publication 60. Ann ICRP 1991: 1-3.
10. Okpala, O., 2004. Survey of Radiation Protection Facilities in Some Parts of Nigeria (Enugu and Anambra States). Journal of Biomedical Investigation, 2(1): 17-21.
11. Eze, K., C. Nzotta, T. Marchie, B. Okegbunam and T. Eze, 2011. The State of Occupational Protection and Monitoring in Public and Private X-ray Facilities in Edo State, Nigeria. Nigerian Journal of Clinical Practice, 14(3): 308-310.