AN EVALUATION OF THE RADIATION SAFETY CULTURE AMONG RADIATION HEALTH PROFESSIONALS IN KANO METROPOLIS

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ABSTRACT

Background: The use of ionizing radiation in medical imaging contributes the largest amount of man-made exposure to the public and there is no safe dose of ionizing radiation.

Aim: To assess the radiation safety culture in the practice of radiation health workers in Kano Metropolis.

Methods: Ninety-two structured questionnaires were administered to the consented radiation health professionals in Kano metropolis. The questionnaire, designed to evaluate the knowledge and practices of radiation protection, fielded questions on the principles of radiation protection, knowledge of radiation effects, knowledge of the national protection regulatory body, use of radiation monitoring devices, use of protective devices, beam collimation in practice, provision and use of lead aprons by care-givers, as well as the availability and utility of a quality assurance (QA) programme. The collected data was analyzed using descriptive statistics: frequency, mean and percentages. Information collated were organized and presented in simple percentages, while good safety culture was rated by a score of 50% or better, drawing from the average scores from the assessed parameters.

Results: Of the eighty-eight percent (n = 81) questionnaires returned, 78.3% (n = 72) were correctly filled. The results show that the radiation health professionals in the study were knowledgeable (100%) in radiation protection. Summarily, sixty-four percent (n = 46) of the respondents had scores of over 50%, indicating a good radiation safety practice while the remaining 36% (n = 22) scored below 50%, indicating poor safety culture.

Conclusion: Radiation health professionals in Kano metropolis have a good radiation safety culture

Keywords: Radiation safety culture, radiation health professionals and Kano metropolis

INTRODUCTION

Radiation protection is a term applied to concepts, requirements, technologies and operations related to protection of people against the harmful effects of ionizing radiation. Radiation protection safety culture is an attitude and behavior shared by all those involved with protection responsibilities, from workers through management levels, which ensures that protection and safety issues receive the attention warranted as an overriding priority[1]. The use of ionizing radiation in medical imaging contributes the largest amount of man-made exposure to the public[2]. It has been estimated that about 21% of the total somatic dose and about 10% of the total genetically significant dose arise from medical procedures, the most important contributor being diagnostic radiology[3]. There is no safe dose of ionizing radiation, as in theory it takes only a single photon or particle to cause damage to de-oxyribonucleic acid (DNA) resulting in genetic alteration[4]. Being aware of the harmful effects of radiation, it is necessary to keep the total exposure level as low as consistent with other requirements of practice. In this regard, the International Commission on Radiological Protection (ICRP) recommends that medical exposure should be as low as reasonably achievable (ALARA)[5].

The objective of radiation protection is to define methods of protection for individuals and progeny against the potential risks of ionizing radiation. Fundamental principles of radiation protection are justification, optimization and dose limitation[6].

Thus the exposure to an individual in view of the benefits from the process under optimized procedures and equipment is the goal. Should radiation health professionals always adhere to radiation protection/safety protocols in their daily practices, they could protect themselves, patients and other members of the public from deleterious effects of ionizing radiation. The study aims at evaluating knowledge and practices of radiation safety, as a culture among radiation health professionals in Kano metropolis.

METHODS

The study design is quantitative, descriptive and cross-sectional. Purposive sampling technique was used to select data from three government hospitals and two private radio-diagnostic centers in Kano metropolis. The government hospitals were Aminu Kano Teaching Hospital, Murtala Mohammed Specialist Hospital and National Orthopedics Hospital, Dala. The private centres were Mecure and Providian. Convenience sampling method was used to select the respondents in the selected centers. After intensive literature review a structured questionnaire was formulated. A pilot study was used to test the validity of the measuring tool. The Cronbach alpha reliability test was used to test the internal consistency of the questionnaire and reliability coefficient was found to be 0.886.

The questionnaire was designed to evaluate the knowledge and practices of radiation health professionals in Kano metropolis. Section A of the questionnaire bore the demographic data of the respondent. Section B fielded questions to evaluate the knowledge of radiation protection among radiation health professionals in Kano metropolis while section C contained questions set to explore the practice of radiation protection. A consent form was attached to every questionnaire in order to obtain the consent of the respondents. The questions raised included; the fundamental principles of radiation protection, the major effects of ionizing radiation on human body, the regulatory body for radiation protection in Nigeria, the application of the ten day rule, radiation dose limits for radiation workers, members of the public and pregnant women and at what stage of foetal development tissues are more susceptible to ionizing radiation.

Questions asked under radiation protection practices were wearing of radiation monitoring devices, provision of lead aprons to patient relatives assisting in the exposure area, collimation of the X-ray beam to region of interest, the use of lead gloves, gonadal shield, thyroid shields during examination, as well as the availability and utility of a quality assurance programme.

The radiation health professionals included in the study were Radiographers, Consultant Radiologists, Resident Radiologists and Medical Physicists. Professionals that do not dispense ionizing radiation and workers not directly involved with ionizing radiation were excluded from the study. A total of ninety-two questionnaires were administered to the consented radiation health professionals in the selected centers. Eight-one of these were returned of which seventy-two were correctly filled and the collected data was organized with the SPSS version 16.0 software. Safety culture was assessed as good if the average score by respondents was 50% or better. Poor scores, below 50% implied poor protection safety culture.

RESULTS

Respondents consisted of 87.5% (n = 63) males and 12.5% (n = 9) females, aged 26 to 50 years (mean = 33.2±9.6). The distribution of the respective professions studied is as shown in Figure 1 below. Sixty percent (n = 43) of the respondent were radiographers, 30% (n = 22) were resident radiologists and the remaining 10% (n = 7) were consultant radiologists. No Medical Physicists were participated in the study.

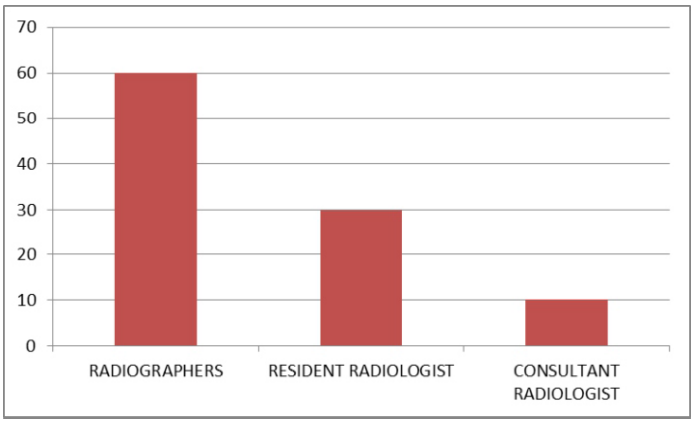

Figure 1: Distribution of respondents by professions

Out of the seventy-two correctly filled questionnaires, 77.8% (n = 56) were filled by respondents at Aminu Kano Teaching Hospital, 7% (n = 5) by the respondents at Murtala Muhammad Specialist Hospital, 7% (n = 5) were filled by respondents at Providian Diagnostic Center, 5.6% (n = 4) by respondents at National Orthopedics Hospital, Dala and 2.8% (n = 2) at Mecure Diagnostic Centre as shown on Figure 2, below.

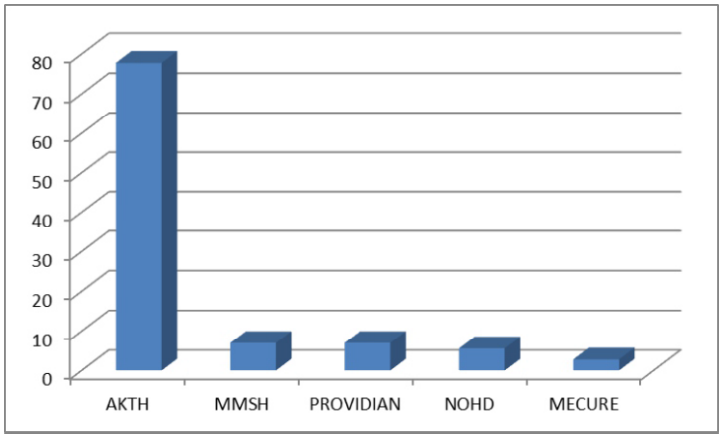

Figure 2: Distribution of Respondents by Workplace

Fifty-six percent (n = 40) of respondents had 0-4 years working experience; 32% (n = 23) respondents had 5-9 years working experience; 11.1% (n = 8) had 10-14 years working experience and only 1.4% (n = 1) had worked for more than 15 years.

57% (n = 41) of the respondents knew the fundamental principles of radiation protection, 93.1% (n = 67) had awareness of the two basic effects of ionizing radiation on human body. 94% (n = 68) of the respondents were acquainted with the regulatory body responsible for radiation protection in Nigeria. At least 94.4% (n = 68) have knowledge of the categories of patients to whom the ten day rule is applicable. Furthermore, 51.4% (n = 37) had knowledge of radiation dose limits for radiation workers, other members of the public and pregnant women. Also 83.5% (n = 63) showed knowledge of when the foetal tissues are more susceptible to ionizing radiation. The percentage scores for knowledge of protection for all professionals is as shown in Table 1.

Table 1: Percent Scores for Knowledge of Professionals of Radiation Protection

Rating	PRP			BEIR			Reg. Agency			ATDR			RDL			WFTIS		
	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR
Good	512	545	100	88.4	100	100	93.1	100	100	90.7	100	100	62.8	72.7	71.4	83.7	100	100
Poor	48.0	45.0	0.0	11.6	0.0	0.0	6.9	0.0	0.0	9.3	0.0	0.0	37.2	27.3	28.6	16.3	0.0	0.0

PRP - Principle of Radiation Protection; BEIR - Basic Effect of Ionizing Radiation; Reg. Agency – Regulatory Agency
ATDR – Application of the Ten Day Rule; Radiation Dose Limits; WFTIS – When Foetal Tissues are more susceptible
RAD – Radiographers; RR – Resident Radiologists; CR - Consultant Radiologists

31% (n = 22) of the respondents wore radiation monitoring devices daily during working hours, while 45.8% (n = 33) wore the radiation monitoring devices occasionally during working hours, but the remaining 23.6% (n = 17) didn't wear radiation monitoring device during working hours. 68% (n = 49) gave patient relatives lead apron to wear while assisting patient during exposure while 31.9% (n = 23) occasionally gave patients relative lead apron to wear while in the exposure room. 99% (n = 65) made X-ray beam collimation to the region of interest before exposure, 5.6% (n = 4) sometimes made the collimation before exposure but 4.2% (n = 3) didn't make any X-ray beam collimation before exposure. Only 18.1% (n = 13) of the respondents used lead gloves, gonadal shields and thyroid collars during examination while they were in the exposure area, 44.4% (n = 32) made an occasional use of lead gloves, gonadal shield and thyroid collar during examination while they were in the exposure area but 37.5% (n = 27) didn't use lead gloves, gonadal shield and thyroid collar during examination while in the exposure area. 94% (n = 68) showed that there was no established quality assurance program in their centers while 5.6% (n = 4) shows the availability of quality assurance program in their centers. The percentages of performance of radiographers on radiation protection practices, resident radiologist and consultant radiologist are shown on Table 2.

Table 2: Percent Scores for Knowledge of Professionals of Protection Practices

Rating	URMD			GLATR			UC			U LGGS			AQAP		
	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR	RAD	RR	CR
Yes	30.0	31.8	100	65.1	72.7	71.4	88.4	90.9	100	39.5	68.2	100	6.9	0.00	14.3
No	32.5	9.1	0.0	0.0	0.0	0.0	2.3	0.0	0.0	53.5	0.0	0.0	93.1	100	85.7
Sometimes	39.5	59.1	0.0	34.9	27.3	28.6	9.3	9.1	0.0	7.0	31.8	0.0	0.0	0.0	0.0

URMD – Use of Radiation Monitoring Devices; GLATR – Giving Lead Apron to Patient Relatives; UC – Use of Collimators
ULGGS – Use of Lead Gloves and Gonad Shields; AQAP – Availability of Quality Assurance Programme.
RAD – Radiographers; RR – Resident Radiologists; CR - Consultant Radiologists

DISCUSSION

As long as radiation protection measures are well implemented by radiation health professionals, the risks associated with diagnostic use of ionizing radiation could be minimized.

Radiation health professionals in Kano metropolis are restricted to teaching and specialist hospitals. Thus, the study was limited to only those hospitals. There was no Medical Physicist or Radiation Safety Officer in the entire study population as at the time of the study. From the results of this study, radiation health professionals appear to have good knowledge of radiation protection, since all the respondents scored above 50%. These results agree with studies by Rania et al[7] and Maryam and Abbas[8], assessing awareness and attitude of Radiographers in radiation in Saudi Arabia and Iran, respectively. These studies revealed good knowledge and awareness of radiation protection issues. A similar study by Cletus et al[6]. on the assessment of radiation protection practice showed good performance towards radiation protection among radiographers in Lagos, Nigeria.

About 33% of respondents had poor radiation protection practices with scores under 50%. This was against the expectation of good radiation culture drawing from high knowledge base of the respondents (100%). The poor radiation protection practices might be due to lack-luster attitude among the respondents. The results suggest that the status and experience level of practitioners may be a factor relating to protection culture. The Consultant Radiologists recorded scores between 80 – 90%. 91% (n = 20) of the Resident Radiologists recorded good radiation protection practices while fifty-six percent (n = 24) of the Radiographers in the study recorded good radiation protection practices. It is rather disturbing that up to 44% (n = 19) of Radiographers were rated poorly in radiation protection practices. The implication of this in practice would indicate a near average score for safety culture among radiographers. Radiologists generally have limited exposure to radiation in special examinations but have shown more concern for protecting themselves. This may account for the better scores among Radiologists than the Radiographers.

CONCLUSION

The radiation health professionals in Kano metropolis have overall good knowledge of radiation protection. The Consultant Radiologist and Residents Radiologist practices radiation protection more than the radiographers. An above average score was recorded for radiation safety culture among radiation health workers in Kano metropolis.

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