

CLINICAL PRACTITIONERS' KNOWLEDGE OF IONIZING RADIATION DOSES IN DIAGNOSTIC RADIOLOGY EXAMINATIONS IN CALABAR

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ABSTRACT

BACKGROUND: Observation has shown a preponderance of irrelevant, unjustified and perhaps unnecessary radiological requests in the study area. The consequences of this on the patients' doses and population collective dose may be dire.

OBJECTIVE: To assess Clinicians/Referrers' knowledge of radiation doses of patients undergoing radiological examinations.

METHODOLOGY: A prospective, non-experimental, cross-sectional survey of clinicians (except radiologists) in various hospitals in Calabar metropolis, Cross River State, Nigeria, was conducted. A pretested and validated questionnaire was designed to extract responses on rating of effective doses for commonly requested imaging examinations, using the value for the posterior-anterior (PA) chest x-ray as reference. Questions on radiosensitivity of different organs, imaging modalities that use ionizing radiation and considerations for the choice of ionizing radiation (IR) based examinations were included. Participants were also asked for their preferred methods of filling any knowledge gap on IR issues. Responses were presented in simple percentages.

Results: A total of 104 respondents, made up of 63.5% males and 36.5% females participated in the study. At least 70% and 42% of the respondents, respectively, were aware that Ultrasound and Magnetic Resonance Imaging were not IR based modalities. About 67.3% of the respondents did not know the doses of commonly requested radiological examinations. This result was not dependent on clinicians' demography. A total of 61.5% of the respondents referred patients for IR examinations even when the result was unlikely to alter their diagnosis or treatment; but to reassure the patient (98.8%), meet expectations of patients (35%) or to give the patient the feeling of being taken seriously (75%).

CONCLUSION: Participating Clinicians in this study have showed poor knowledge of radiation doses of commonly requested radiological examinations. Most participants suggested improvement of their knowledge of radiation doses through continuous medical education and by the provision of referral guidelines.

KEYWORDS: Clinicians, Ionizing radiation, radiology, practitioners, knowledge.

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INTRODUCTION

Everyone living is constantly exposed to ionizing radiation with about 18% of such exposure coming from man-made sources¹. The deleterious effects of ionizing radiation are common knowledge. These effects vary according to the dose and duration of exposure². Globally, there is an increasing utility of ionizing radiation based diagnostic services, with over 70% of the global population reportedly being exposed to medical x-rays annually³. It has been estimated that 100-250 deaths occur each year from cancer arising from medical exposure to radiation⁴.

X-ray imaging has become a veritable diagnostic tool in

medicine⁵. For these, patients are referred for diagnostic examinations by clinicians from the broad spectrum of clinics in the hospital. Referrals are premised on the principle of justification, a fundamental concept on which radiation protection is based^{6,7}.

Observation has shown a plethora of radiological requests. Several studies have shown incomplete and often insufficient filling of radiology requests forms⁸⁻¹¹. Some of these requests have been observed to be unjustified. The consequence of this to the population collective dose can only be imagined. In order to reduce the incidence of unwanted radiation doses in radiology examinations, proper justification of referral practices need to be assessed among the referring clinicians. Previous studies have highlighted the heterogeneity and inadequacy of knowledge of radiation doses

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among clinicians in several environments¹². Similar studies have not been conducted among referring clinicians in Calabar metropolis, Cross River State.

The objective of this study was to assess the referring clinicians' knowledge of ionizing radiation doses for commonly requested radiological examinations in Calabar metropolis, Cross River State, Nigeria. The results would be useful in defining measures for the optimization of the radiology referral procedures and therefore lead to the reduction in the volume of unnecessary radiation exposure of patients.

METHODOLOGY

This was a non-experimental, cross sectional study carried out prospectively in major public and private owned hospitals in Calabar metropolis, Cross River State, South-South Nigeria. The study targeted all the clinicians (except radiologists) working in different units of hospitals in the area, and lasted between July to October, 2015. The instrument for data collection was a pretested and validated, semi-structured, self-completion questionnaire designed to meet the objectives of the study.

In the questionnaire were listed commonly requested radiological investigations for which clinicians were asked to estimate effective doses involved using the dose of postero-anterior (PA) chest x-ray as a reference. The reference dose used was based on the International Council on Radiological Protection (ICRP) report 2008¹³. Questions on radiosensitivity of different organs of the body, imaging modalities that use ionizing radiation, considerations for requesting the use of ionizing radiation (IR) were included. Also, participants were asked questions about their preferred method of filling any existing knowledge gap. A total of 160 questionnaires were distributed using a convenient sample size, but only 104 were correctly and completely filled and returned. Simple percentages and charts were used to present the results. Since a general knowledge of clinicians was the goal, the sample population was treated as a block. No reference was made to what sector of practice or specialization the respondents were drawn from.

RESULTS

Respondents comprised of 66 males and 38 females. Of the 104 questionnaires received, at least 40% were filled by Medical Officers. Participants from the Consultant cadre were only 7.7% (Table 1).

Table 2 shows the responses identifying the imaging modalities that utilized ionizing radiation. Only 62.8% of the respondents correctly classified all the listed

modalities. Over half of this number fell into the Consultant category, suggesting that experience and training may be a major contributor to the results.

Table 1: Distribution of clinicians that participated in the study.

Clinical cadre	Number of respondents	Percentage (%)
Consultant	8	7.7
Resident	36	34.6
Medical officer	42	40.4
House officer	18	17.3
Total	104	100

Table 2: Respondents' identification of imaging modalities that use IR and those that do not use IR.

Modalities using IR	Correct	Incorrect	Unsure
Conventional radiography (x-ray)	98	6	-
Computed tomography (CT)	62	32	10
Fluoroscopic studies (Barium)	30	26	48
Radionuclide imaging (RNI)	62	41	1
Modalities not using IR			
Ultrasound	72	20	12
Magnetic resonance imaging (MRI)	28	71	5

Between 60 and 70% of respondents were unsure of whether the respective doses for the listed examinations were less than, equal to or greater than the reference dose. The information in Table 3 reveals that procedures like IVU, Barium meal, Head CT and Lumbo-sacral x-ray examination were rated as having lower effective doses than the reference chest radiography dose. Interestingly, at least 19% of respondents felt abdominal ultrasound examination had the same effective dose as the reference examination.

Table 3: Clinicians' rating of various imaging examinations doses with reference.

Examination Type	Rating (% of respondents)			
	Less than	Equal to	Greater than	Unsure
Skull x-ray	13.5	13.5	7.7	65.4
Paranasal sinuses	13.5	15.4	5.8	65.4
Post nasal space	13.5	13.5	7.7	65.4
Plain abdomen	23.1	7.7	3.8	65.4
Lumbosacral spine	23.1	5.8	5.8	65.4
Pelvis	23.1	9.6	-	67.3
Knee joint	-	5.8	26.9	67.3
Thoracic spine	25	7.7	-	67.3
Cervical spine	9.6	13.5	9.6	67.3
IVU	30.8	1.9	-	67.3
Barium enema	32.7	-	-	67.3
Barium meal	28.8	3.8	-	67.3
Head CT	23.1	3.8	-	73.1
CT Chest	32.7	-	-	67.3
CT Abdomen	32.7	-	-	67.3
Abdominal ultrasound	-	19.2	13.5	67.3
Head MRI	-	17.3	15.4	67.3

Table 4: Table showing the number and percentage of respondents who correctly identified the degree of radiosensitivity of different organs to IR.

Organ	No. of correct respondents	Percentage
Colon	34	32.7
Gonads	62	59.8
Stomach (SI)	12	11.5
Lungs	16	15.4
Breast	28	26.6
Bladder	8	7.7
Thyroid	32	30.8
Brain	22	21.1
Skin	8	7.7
Bone marrow	10	9.6

SI: Small intestine

Most respondents (about 60%) were at home with the gonads as a highly radiosensitive tissue but tissues like the small intestine and the bone marrow were largely incorrectly identified.

Table 5: Rating of various considerations for requesting imaging examinations for patients.

Consideration	VI	Important	MI	LI	NI
Impact on the diagnosis	72 (70.6)	24 (23.5)	6 (5.9)	0(0.0)	0(0.0)
Impact on the treatment	60 (63.8)	22 (23.4)	8 (8.5)	2(2.2)	2(2.1)
Patient's wishes	8 (8.7)	8 (8.7)	18(19.6)	24(26.1)	34(37.0)
Radiation dose to the patient	14 (15.2)	24 (26.1)	52(56.5)	1(2.2)	0(0.0)
Cost	6 (6.5)	18 (19.6)	20(21.7)	36(39.1)	12(13.0)

VI - very important, MI - moderately important, LI - Least important, NI - not important. Figures in parenthesis are percentages.

The impact of the radiographic examination on diagnosis (N = 72) and treatment (N=60) were the respondents' most important consideration for radiological requests. At 56.5 %, patients' radiation dose was considered moderately important by the respondents. Notwithstanding, more than 60% of respondents made referrals even when they were not required (Figure 1). The reasons given for this action ranged from reassurance of the patient (98.8%), giving the patient the feeling of being taken serious (75%) and fulfilling the patients expectations (35%) (Figure 2). Responses reflect the opinion of the participants that the results obtained in this study were correctable. It is shown in Table 6 that only 7.7% of the respondents had attended any form of training in IR. Almost 60% preferred CMEs and provision of referral guidelines (34.6%) as some of the measures that could help bridge the knowledge gap (Figure 3).

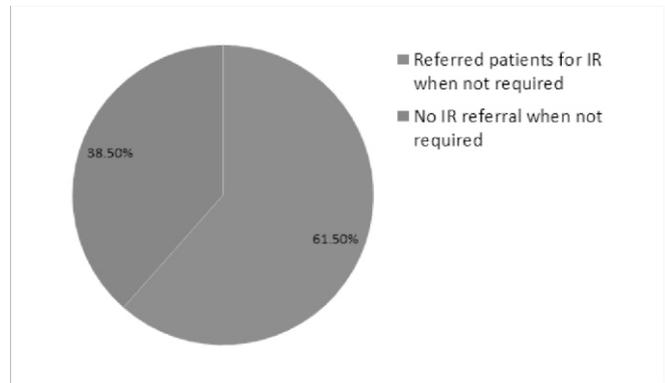


Figure 1: Respondents practices related to patients referred for IR investigations.

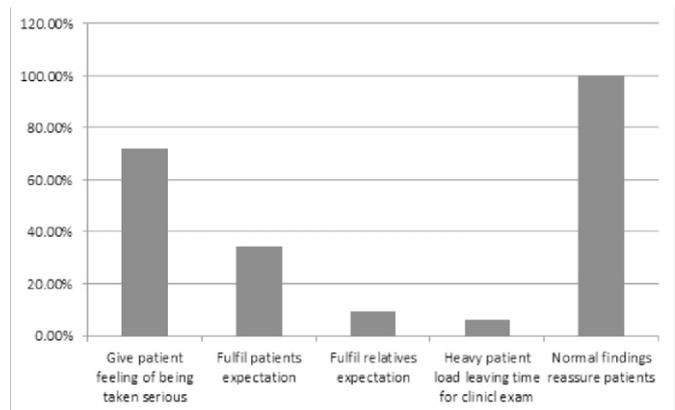


Figure 2: Reasons for referring patient for imaging when it would not alter the diagnosis or treatment plan.

Table 6: Respondents' attendance at Continuous Medical Education in IR protection

Attended continuous Medical education on Ionizing radiation protection	Number	Percentage
Yes	8	7.7
No	96	92.3
Total		

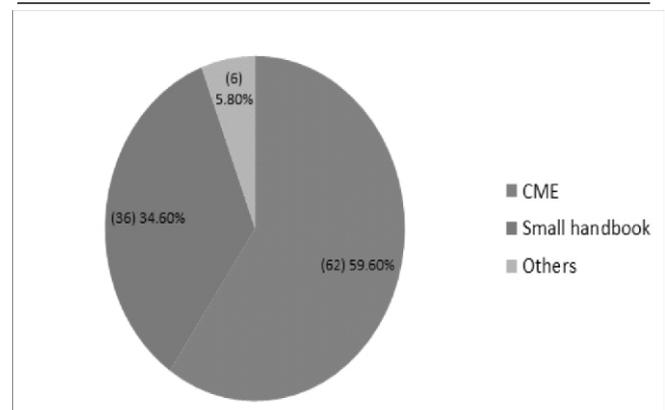


Figure 3: Preferred mode of filling the knowledge gap.

DISCUSSION

The radiation burden arising from diagnostic radiography examinations has been a matter of concern in many studies¹⁴⁻¹⁶. The objective of this study was to assess the knowledge of clinicians who make referrals for these examinations, of the radiation doses to patients undergoing radiological examination in Calabar metropolis.

The greater percentage of the clinicians that participated were males (63.5%) and females making up only 36.5% (Table 1). Medical officers accounted for the largest percentage (40.4%) of participants. This may probably be because they were more readily available and accessible.

The results obtained reveal, as expected, that the impact of the radiographic examination on diagnosis (N = 72) and treatment (N=60) were the respondents major considerations for radiological examinations' requests. Patient radiation doses were considered moderately important by 56.5 % the respondents. This is acceptable in view of the RP justification philosophy. Radiologic examinations must be requested if the benefit to the patient is seen to outweigh the demerits¹⁷.

The interesting finding that some respondents (over 60%) made referrals even when they were not required (Figure 1) may be due to inexperience. Also it may probably be a reflection of our sample population being unwittingly skewed in favour of the lower cadre practitioners. The reasons given for this action including but not limited to reassurance of the patient, giving the patient the feeling of being taken serious, fulfil patients expectations (Figure 2) are rather unscientific. This may be a strong justification for this study.

The fact that only 7.7% of the respondents had attended any form of training in IR (Table 6), may be a reflection of the value placed on gaining knowledge in this area of medical practice. This study shows the existence of a knowledge gap with respect to the familiarity of patient radiation doses among referring clinicians. While it is not expected that clinicians know all doses, it is useful if they can appreciate the trend in doses relative to examination type requested. To this end, almost 60% of respondents showed preference for attendance at CMEs, while the provision of referral guidelines was identified by 34.6% as some measures that could help bridge the knowledge gap (Figure 3).

The above results are not limited to the area of study as studies have shown¹⁸⁻²⁰. Clinicians in these studies performed poorly in estimating the radiation dose for common radiographic examinations and largely overestimated the doses of the listed radiological

investigations. Studies in the UK,^{21,22} Ethiopia²³, Iran²⁴ and elsewhere^{25,26} report heterogeneous results ranging from poor to average rating of clinicians knowledge of ionizing radiation doses.

For MRI and ultrasound imaging in the current study, over 70 and 28 of the 104 respondents, respectively rated these modalities correctly as non-ionizing radiation based (Table 3). This reveals a better performance of Clinicians than was reported by Ahidjo et al.¹⁸ whose study recorded 14% of clinicians correctly rating MRI as non IR based, and Mohammed et al.²⁰ who found only 16.3% of surveyed clinicians correctly rating MRI and Ultrasound as non-ionizing radiation modalities. One study²⁷ reports that over a third of respondents incorrectly believed that MRI emitted a dose equal or lower than the reference chest radiography dose.

The foregoing suggests the need for increased exposure of Clinicians to information on radiological examination doses and radiation effects. This, as has been suggested by respondents, may be achieved by increased attendance at CMEs, development and provision of small handbooks with referral guidelines. Most of the 5% of respondents who suggested other methods of bridging the gap recommended curriculum review for Radiology postings during the clinical years before graduation, to cover this area.

CONCLUSION

The foregoing has shown a gap in the knowledge of Clinicians with respect to radiation doses arising from commonly referred radiographic examinations. Increased training through CMEs and provision of referral guidelines have been suggested as ways of reducing this gap.

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