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Comparative Analysis of Radiation Protection Measures Used in Both Government and Private Radio-diagnostics Facilities in Port Harcourt Metropolis

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Abstract- Background: Radiographers, as healthcare workers bears the brunt of all the workplace hazards and as well faced with the most significant impact of occupational hazard due to the risk of poor and inadequate diagnostic machines, and poor knowledge regarding infection prevention measures. This study assessed and compared radiation protection measures in selected government and private radio-diagnostic facilities in Port Harcourt Metropolis. The study evaluated the availability of radiation protective equipment, compliance with radiation safety standards, and radiation dose levels in the selected facilities. Materials and methods: A cross-sectional research design was adopted using structured questionnaires and direct radiation measurements obtained with a survey meter. A total of 24 respondents participated in the study. Data were analyzed using descriptive statistics, independent sample t-test, and one-way ANOVA at a 0.05 level of significance. Results: The findings revealed that radiation protective equipment was generally available in both government and private facilities. Lead aprons were the most available protective devices, while thyroid shields were the least available, with only two recorded across all facilities. The mean availability score for radiation protective equipment was 1.60 ± 0.43 in government facilities and 1.63 ± 0.40 in private facilities. The mean radiation protection practice score was 3.62 ± 0.58 for government facilities and 3.60 ± 0.55 for private facilities. Independent sample t-test showed no statistically significant difference between government and private facilities in radiation protection practices ($t = 0.03$, $p > 0.05$), availability of equipment ($t = 0.17$, $p > 0.05$), and compliance with safety standards ($t = 1.63$, $p > 0.05$). However, one-way ANOVA revealed a significant difference among the selected facilities ($F = 256.96$, $p < 0.05$. Conclusion: The study concludes that radiation protection measures were generally implemented in both facility types. However, improvements in equipment availability, monitoring, maintenance, and staff training are required to further enhance radiation safety practices.

Keywords: Equipment, Radiation Protection, Shielding

I. INTRODUCTION

This practice of radiation protection is essential for safeguarding the well-being of both staff members, patients and as well as the general public against the potential consequences of excessive radiation exposure during and following radiological procedures [1].

Radiographers, as healthcare workers bears the brunt of all the workplace hazards and as well faced with the most significant impact of occupational hazard due to the risk of poor and inadequate diagnostic machines, and poor knowledge regarding infection prevention measures[2].

Radiographers face different types of infection challenges when conducting routine examinations. This infection challenges ranges from physical, psychological, biological, ergonomic and chemical hazards. More so, the radiographers are faced with cross-infection between patients and care givers, and infections associated with the use of diagnostics machines[3].

The medical use of ionizing radiation contributes the largest amount of man-made radiation exposure and ranks second to natural background radiation and adhering to the standard radiation protection measures minimizes radiation dose to patients, staff, and other public members [4]. It is important for radiographer to understand the potential risks of radiation [5] . Therefore, to reduce the adverse effects of x-radiation, adequate knowledge of risks of x-rays, safety methods and precautionary measures relating to handling of diagnostic machines is required among the radiographers [6].

X-ray is the most frequently used ionizing radiation for diagnostic imaging and it plays a significant role in effective healthcare delivery both in developed and developing countries [7]. It is known that of all man-made sources of ionizing radiation, diagnostic x-ray contributes the largest part to the collective population dose leading to somatic and genetic effects on human beings While radiographic imaging holds immense value as a diagnostic tool in the field of medicine, it's imperative to recognize the well-established risks associated with ionizing radiation and computed tomography (CT) scans[8].

As it has been observed subjectively, over the past three (3) years, that there has been an increase in the number of radio-diagnostic centers in Port Harcourt Metropolis, Rivers state and these invariably could lead to extra radiation dose to practitioners as well as patients and the public [9]. The ineffective shielding of radiation by both government hospitals and private diagnostic centers while using it in medical practice has caused a whole lot of problems. This is due to the fact that the effectiveness in shielding of radiation is dependent on the stopping power of radiation particles (rate at which a charged particle loses energy as it travels through a material), which varies with the type and energy of radiation and the shielding material used[10].

Radiographers in Nigeria are exposed to very high radiation risk because of great dependence on refurbished x-ray equipment and should have absorbed doses monitored[11]. The importance of protection practices by radiographers to keep ionizing radiation doses as low as reasonably achievable can never be over emphasized given its obvious detrimental effects. Despite this obvious reason, most centers continue to operate without monitoring their employees in south-South Nigeria[10]. Radiographers in Nigeria are exposed to high radiation risk due to dependence on refurbished equipment (12,13]. It is therefore necessary that the values gotten from both the government and private establishment be compared for the sake of review.

Regular monitoring of radiation doses received by staff in radiology department is of great importance to protect the staff, patients and the public from the effect of excessive radiation during and after radiological examinations of patients[14]. This will ensure occupational safety as dose limits will consciously not be exceeded. The accepted dose limits for occupational staff as reported by the International Commission on Radiological Protection (ICRP) is 20 mSv per year averaged over five (5) years (100 mSv in 5 years).

Subjectively, it has been observed in Port Harcourt, Rivers State that radiographers are often concerned about chronic radiation doses they absorb occupationally [9]. Radiographers in private practice have been adjudged mindful of radiation practices which reduces dose both to patient and staff when compared to their government counterpart in the western world[15]. However, there is no available literature on the comparison of radiation protection measures in both private and government radiological facilities in Rivers state to the best of researcher's knowledge. Therefore, it is worthy of interest that the dose output in government and private sector be compared in Rivers state, Nigeria and Implementing personnel and radiation safety monitoring emerges as a critical safety measure in the practice of radiography.

II. MATERIALS AND METHODS:

Study Design: This was a comparative cross-sectional conducted to assess and compare the radiation protection measures implemented in both government and private radio-diagnostic facilities in Port Harcourt Metropolis.

Area of study/location.

The study will be conducted in Port Harcourt Metropolis, the capital of Rivers State, Nigeria. Port Harcourt is a highly urbanized area with several public and private hospitals offering diagnostic imaging services using ionizing radiation [15]. .

For this study, two government and two private owned radio-diagnostics/hospitals within Port Harcourt metropolis were purposively selected based on their active engagement in radio- diagnostics services. The hospitals are denoted as government hospital one and two respectively (GH1 and GH2) and private hospital one and two respectively (PH1 and PH2).,

Population of Study.

The population of study comprised licensed radiographers, radiologists, and x-ray technicians working in both government-owned and privately-owned radio-diagnostic centers/hospitals in Port Harcourt metropolis. Only staffs directly involved in the use, supervision, and implementation of radiation safety measures were included. These professionals operate diagnostic equipment such as X-ray, fluoroscopy and CT machines, and are expected to apply standard radiation protection measures. The total sample size of 24 respondents, comprising 16 from government hospitals and 8 from private hospitals within Port Harcourt Metropolis were included in this study based on the inclusion and exclusion criteria, which include but not limited to;.

Inclusion Criteria

The following criteria were used to include participants in the study:

i. Radiographers, radiologists, and x-ray technicians actively working in any of the selected radio-diagnostic facilities in Port Harcourt metropolis.
ii. Staff who have spent at least 6 months in their current place of employment.
iii. Individuals who gave informed consent to participate in the study.

Exclusion Criteria

Participants were excluded from the study if they met any of the following conditions:

i. Staff on probation, internship, or industrial training.
ii. Individuals with less than 6 months of work experience in the selected facility.
iii. Personnel unwilling to provide informed consent or unavailable during the period of data collection.
iv. Non-technical staff (e.g., administrative, cleaning, or security personnel).

Inclusion criteria for including facilities.

i. Facilities must be situated within Port Harcourt city limits or metropolitan area of Rivers State.
ii. The facility must offer at least one form of diagnostic radiology service (e.g., X-ray, CT, mammography, fluoroscopy).
iii. The facility must be currently functional and actively attending to patients at the time of data collection.
iv. The facility should be registered and approved by the Rivers State Ministry of Health or Medical and Dental Council of Nigeria (MDCN).
v. Facility administrators must give consent and permit participation of their radiology staff in the study and willingness to Participate.
vi. Facility must possess and use ionizing radiation equipment such as X-ray, CT scanner, or fluoroscopy unit.

Ethical Consideration

Before the commencement of the study, ethical approval RSU/FBMS/RCE/25/320 was obtained from Research Ethics Committee of the Faculty of Basic Medical Sciences, College of Medical Sciences, Rivers State University, Port Harcourt. Permission will also be sought from the management of each selected radio-diagnostic facilities. All Participants will be duly informed about the purpose, significance, and procedures of the study, consent will be obtained prior to participation and also be assured that participation will be entirely voluntary and participant will be informed of their right to withdraw from the study at any stage without consequences. Confidentiality and anonymity of all information provided will be strictly maintained and participant will be assured that data collected will be used solely for research purpose

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Instrument for data collection

Two instruments were used for data collection in this study: a structured questionnaire and a radiation survey meter.

The structured questionnaire was developed by the researcher to obtain information from radiographers and other relevant personnel regarding radiation protection practices in the selected radio-diagnostic facilities. The questionnaire was divided into sections designed to address issues such as: Structured Questionnaire/Checklist. Designed to collect data on knowledge, attitudes, and practices regarding radiation protection measures and also used to assess physical safety measures (e.g., shielding, lead aprons, warning signs, equipment servicing logs) in each facility.

Validity and reliability of the instruments

To ensure the validity of the research instrument, the questionnaire and checklist were reviewed by experts in radiography, research methodology and medical physics to ensure content relevance, clarity and alignment with the study objectives. The reliability of the questionnaire was determined using Cronbach's alpha reliability coefficient to assess the internal consistency of the questionnaire items. The reliability coefficient 0.70 obtained indicated that the instrument was sufficiently reliable for the purpose of the study

Method of data collection

Data were collected through the administration of questionnaires and environmental radiation measurements. Copies of the questionnaire were distributed directly to radiographers and other relevant staff in the selected hospitals. Respondents completed the questionnaires, and all completed copies were retrieved for analysis.

Method of Data Analysis

Data obtained from the questionnaire were coded and analyzed using both descriptive and inferential statistical techniques. Descriptive statistics such as frequency distribution, percentages, mean ($\bar{x}$), and standard deviation (SD) was used to answer the research questions. Inferential statistical tools such as the independent sample t-test and ANOVA were used to test the research hypotheses at a 0.05 level of significance.

Measurement of Variables

Response from the questionnaire were structured using the scale as shown below

(A) Knowledge, Attitude and Practices Scale.

Response	Rating Scale	Boundary Limits
Strongly Agree	4	3.01 – 4.00
Agree	3	2.01 – 3.00
Disagree	2	1.01 – 2.00
Strongly Disagree	1	0.01 – 1.00

(B) Availability Scsle

Response	Rating Scale	Boundary Limits
Available	2	1.01 – 2.00
Not Available	1	0.01 – 1.00

(C) Compliance Scale

Response	Rating Scale	Boundary Limits
Always	3	2.01 – 3.00
Sometimes	2	1.01 – 2.00
Never	1	0.01 – 1.00

To interpret the level of compliance, a criterion mean of 2.00 was established. Therefore, mean values of 2.50 and above indicate high compliance; mean values between 2.00 and 2.49 indicate moderate compliance, while mean values below 2.00 indicate low compliance with radiation safety standards.

However, since your compliance scale is:

| Always = 3 |
| Sometimes = 2 |
| Never = 1 |

The cut-off point (decision benchmark) is:

$$\frac{3+2+1}{3} = 2.0$$

So interpretation becomes:

- Mean ≥ 2.50 → High Compliance
- Mean 2.00 – 2.49 → Moderate Compliance
- Mean < 2.00 → Low Compliance

Mean Score $\bar{x}$

The analysis began with a mean score rating and measure of standard deviation as

$$\bar{x} = \frac{\sum x}{N} \quad (3.3)$$

Where;

x = Each individual response value (converted to numerical form according to rating scales shown in the tables below)

$\sum x$ = Sum of all the numerical responses

N = Total number of responses.

$$sd = \sqrt{\frac{x}{N}} \quad \sum_{i=1}^{N}(x_i - \quad)_2$$

To interpret the mean scores obtained from the rating scales, a criterion mean was established. For the 4-point Likert scale (Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1), the midpoint is calculated as:

$$\frac{4+3+2+1}{4} = 2.50$$

Therefore:

- Mean ≥ 2.50 indicates agreement/high level
- Mean < 2.50 indicates disagreement/low level

For the 3-point compliance scale (Always = 3, Sometimes = 2, Never = 1), the midpoint is:

$$\frac{3+2+1}{3} = 2.00$$

Thus:

i. Mean ≥ 2.50 indicates high compliance
ii. Mean 2.00 – 2.49 indicates moderate compliance
iii. Mean < 2.00 indicates low compliance

III. RESULTS

Table 4.1: Demographic characteristics of respondent by facility type

Variable	Gender	Government (n-16)	Private (n-8)	Total	Percentage (%)
	Male	6	4	10	41.7
	Female	10	4	14	58.3
			AGE		
20-29		4	2	6	25.0
30-39		7	3	10	41.7
40-49		3	2	5	20.8
50 and above		2	1	3	12.5

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Years of Experience				
1-5 years	5	2	7	29.2
6-10 years	6	3	9	37.5
11-15 years	3	2	5	20.8
16 and above	2	1	3	12.5
Educational Qualifications				
Diploma	3	2	5	20.8
B.sc	8	4	12	50.0
M.sc	4	1	5	20.8
Others	1	1	2	8.4

Table 1 presents the demographic characteristics of respondents based on facility type. The results show that female respondents constituted the majority 14(58.3%) compared to males 10(41.7%). The age distribution indicates that most respondents fall within the 30–39 years age group 10(41.7%), suggesting that the workforce is predominantly within the active working age. In terms of professional experience, the majority of respondents have between 6–10 years of experience 9(37.5%), indicating moderate professional exposure. Furthermore, most respondents possess a Bachelor's degree 12(50.0%).

Table 2: Frequency and percentage distribution of radiation protection equipment in both government and private Radio-diagnostics facilities.

GOVERNMENT.

Hospital	Numbers of Lead Aprons (0.25-0.5 mmPb equivalent)	Numbers of Gloves	Numbers of Thyroid shield	Number of Gonadal Shielding	Numbers of Lead Glasses.
GH_1	3	`1	0	1	2
GH_2	4	2	1	2	1
TOTAL	7	3	1	3	3

PRIVATE

Hospitals	Numbers of Lead Aprons (0.25-0.5mmPb equivalent)	Numbers of Gloves	Numbers of Thyriod shield	Numbers of Gonadal Shielding	Numbers. of Lead Glasses.
PH_1	4	`3	1	1	1
PH_2	1	0	0	1	1
TOTAL	5	3	1	2	2

GH1: Government Hospital one, GH2: Government Hospital two, PH1: Private Hospital one and PH2: Private Hospital two

The total number of lead aprons recorded across both government and private hospitals was 12, out of which 58.3% were found in government hospitals, while 41.7% were found in private hospitals. For lead gloves, a total of 6 were recorded, with 50.0% available in government hospitals and 50.0% in private hospitals, indicating equal distribution between both sectors. A total of 5 gonadal shields were observed, out of which 60.0% were found in government hospitals, while 40.0% were found in private hospitals. Only 2 thyroid shields were recorded across all facilities, with 50.0% found in government hospitals and 50.0% in private hospitals, reflecting very low availability overall but both

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sectors showed inadequate availability of critical protective tools. .

Table 3: Mean responses and standard deviation on knowledge, attitudes and practices regarding radiation protection measures in government and private radio-diagnostic facilities in Port Harcourt Metropolis

		Government(N = 16)		Private (N = 8)	
S/N	Item	x̄	*sd*	x̄	*sd*
1.	Radiation exposure can be harmful if not well controlled	3.81	0.40	3.75	0.46
2.	Radiation protection is important in all diagnostic procedures.	3.58	0.82	3.50	0.54
3.	You are familiar with the ALARA principle	3.69	0.48	3.63	0.52
4.	Use of protective equipment reduces radiation exposure	3.81	0.40	3.63	0.52
5.	Training in radiation safety is necessary for all staff	3.74	0.45	3.63	0.52
6.	Regular monitoring with dosimeters is essential for radiation workers.	3.63	0.62	3.63	0.52
7.	You have received formal training on radiation protection practices	2.94	1.13	3.25	0.46
8.	Pregnant staff should avoid high radiation areas	3.75	0.45	3.63	1.06
9.	Radiation risks to patients and staff can be minimized with proper shielding	3.56	0.51	3.88	0.35
10.	Protective procedures should be reviewed regularly in your facility.	3.63	0.50	3.50	0.54
	Total	36.14	5.76	36.03	5.5
	Grand Total	3.61	0.58	3.60	0.55

Decision Rule
3.50 – 4.00 = Strongly Agree
2.50 – 3.49 = Agree
1.50 – 2.49 = Disagree
1.00 – 1.49 = Strongly Disagree

Based on the decision rule, the results in table 3 shows that respondents in both government and private facilities demonstrated a high level of knowledge and positive attitudes toward radiation protection, with grand means above 3.50. However, formal training recorded lower agreement, indicating a gap in structured radiation safety training.

Specifically, items such as radiation exposure being harmful, the importance of radiation protection,

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familiarity with the ALARA principle, and the use of protective equipment all recorded mean values above 3.50 in both government and private facilities, indicating strong agreement. However, the item on formal training in radiation protection practices recorded a mean score of 2.94 in government facilities and 3.25 in private facilities, which falls within the range of 2.50-3.49, indicating agreement rather than strong agreement. This suggests that although respondents acknowledge training, it may not be adequately received by all personnel.

The grand mean scores of 3.62 (government) and 3.60 (private) fall within the strongly agree range, indicating an overall high level of knowledge, positive attitudes, and good practices regarding radiation protection measures in both sectors. The standard deviation values, which are generally low, indicate that respondents had relatively consistent opinions across the items.

Table 4: Summary of t-test Analysis on the demonstration of appropriate knowledge, attitudes and practices regarding radiation protection measure in government and private radio-diagnostic facilities in Port Harcourt Metropolis.

Facility	N	x̄	*sd*	df	α-level	t-crit	t-cal	Decision
Government	16	3.62	0.58	22	0.05	2.074	0.03	Not significant.
Private	8	3.60	0.55					

The data presented in table 4 show that government facilities recorded a mean value of 3.62 with a standard deviation of 0.58, while private facilities recorded a mean value of 3.60 with a standard deviation of 0.55. The calculated t-value (0.03) is less than the critical t-value (2.074) at 0.05 level of significance with 22 degrees of freedom. Therefore, the null hypothesis is accepted.

This indicates that there is no statistically significant difference between government and private facilities in terms of knowledge, attitudes, and practices regarding radiation protection measures.

Table 5: Mean responses and standard deviation on compliance with safety standards and regulations in Government and Private Radio-diagnostic Facilities in Port Harcourt Metropolis.

		Government N = 16			Private N = 8		
S/N	Items	x̄	sd	Remark	x̄	sd	Remark
1.	Use of lead apron during exposure	2.44	0.51	Moderate Compliance	2.75	0.46	High Compliance
2.	Monitoring radiation dose with dosimeters	2.06	0.93	Moderate Compliance	2.63	0.52	High Compliance
3.	Regular equipment maintenance	2.19	0.66	Moderate Compliance	2.75	0.43	High Compliance
4.	Staff training on radiation protection	1.94	0.77	Low Compliance	2.75	0.46	High Compliance
5.	Radiation warning signs displayed	2.44	0.81	Moderate Compliance	2.88	0.35	High Compliance
6.	Shielding and positioning to reduce exposure	2.94	0.25	Always High Compliance	2.88	0.35	High Compliance

7.	Restricting access during procedures	2.81	0.40	High Compliance	2.88	0.35	High Compliance
8.	Routine inspection of protection tools	2.00	0.73	Moderate Compliance	2.75	0.46	High Compliance
9.	Avoiding unnecessary repeats of X-rays	2.63	0.50	High Compliance	2.75	0.46	High Compliance
10.	Use of collimators and filtration	2.56	0.73	High Compliance	2.63	0.59	High Compliances
	Total	24.01	6.29		27.56	4.43	
	Grand total	2.40	0.63	Moderate Compliance	2.76	0.44	High Compliance

Data presented on table 5 revealed that both government and private radio-diagnostics facilities in Port Harcourt Metropolis always comply with safety standards and regulations. This is evident in the grand mean of 2.40, 2.76 and combined standard deviation of 0.63, 0.44. However, on the issue of staff training on radiation protection, government facilities comply sometimes as show with the mean of 1.94 and standard deviation of 0.77. Private facilities demonstrate high compliance, while government facilities show moderate compliance. Staff training in government hospitals is a low-compliance area.

Table 6: Summary of t-test Analysis on the demonstration of appropriate knowledge, attitudes and practices regarding radiation protection measure in government and private radio-diagnostic facilities in Port Harcourt Metropolis.

Facility	N	x̄	*sd*	df	α-level	t-crit	t-cal	Decision
Government	16	3.62	0.58	22	0.05	2.074	0.03	Not significant.
Private	8	3.60	0.55					

The data presented in table 6 show that government facilities recorded a mean value of 3.62 with a standard deviation of 0.58, while private facilities recorded a mean value of 3.60 with a standard deviation of 0.55. The calculated t-value (0.03) is less than the critical t-value (2.074) at 0.05 level of significance with 22 degrees of freedom. Therefore, the null hypothesis is accepted.

This indicates that there is no statistically significant difference between government and private facilities in terms of knowledge, attitudes, and practices regarding radiation protection measures.

Table 7: Summary of t-test Analysis on the availability radiation safety equipment in government and private radio-diagnostic facilities in Port Harcourt Metropolis.

Facility	N	x̄	*sd*	df	α-level	t-crit	t-cal	Decision
Government	16	1.60	0.43	22	0.05	2.074	0.17	Not siginificant
Private	8	1.63	0.40					

The data presented in table 7 show that government facilities recorded a mean value of 1.60 with a standard deviation of 0.43, while private facilities recorded a mean value of 1.63 with a standard deviation of 0.40. The calculated t-value (0.17) is less than the critical t-value (2.074) at 0.05 level of significance with 22 degrees of freedom. Therefore, the null hypothesis is accepted.

This indicates that there is no statistically significant difference between government and private facilities in the availability of radiation safety equipment.

IV. DISCUSSIONS

The lack of significant difference between government and private facilities in KAP, availability of protective equipment, and compliance suggests that both sectors have a relatively similar level of awareness and implementation of radiation safety practices. This may be due to regulatory oversight and standardized training in radiology practice.

However, the significant differences observed among individual facilities indicate variations in shielding effectiveness, equipment condition, workload intensity, and adherence to safety protocols. These differences highlight inconsistencies in radiation protection implementation despite overall regulatory standards. This observation reflects the nature of radiographic processes, where secondary radiation contributes to increased exposure levels within the imaging environment. This finding agrees with the work of Williams et al[16], who emphasized the importance of proper radiation monitoring, calibration, and control measures in minimizing occupational exposure.

Similarly, the findings support the report of Nwankwo [(2018), who observed that private radio-diagnostic centres often possess fewer functional protective devices compared to government hospitals. The limited availability of protective equipment may partly explain the higher radiation levels recorded in some private facilities. In contrast, the relatively better radiation control observed in government hospitals aligns with the findings of Eze et al[4], who reported higher levels of staff training and compliance with radiation safety protocols in public healthcare institutions. This suggests that structured training and regulatory enforcement contribute positively to radiation safety practices. Furthermore, the findings are consistent with the work of Adeyemi et al[18], who reported better dosimetry monitoring practices in government hospitals. Effective monitoring systems may help maintain radiation exposure within acceptable limits.

Overall, the study revealed that radiation protection practices in both government and private radio-diagnostic facilities in Port Harcourt Metropolis were relatively similar in terms of knowledge, equipment availability, and compliance with radiation safety measures. However, differences existed among individual facilities when assessed collectively using ANOVA. This suggests that although general radiation safety standards may be in place, the level of implementation varies across institutions. Therefore, continuous monitoring, adequate provision of protective equipment, and strict enforcement of radiation safety guidelines are necessary to ensure uniform compliance across all facilities.

Implications of Findings

The findings have important radiation safety implications for clinical practice and healthcare management.

The observed variations among facilities suggest the need for improved consistency in radiation protection practices. This includes strengthened equipment maintenance, proper shielding, and strict adherence to operational protocols as agreed with Nzotta et al[13]. From a policy perspective, the findings support the need for continuous regulatory monitoring by relevant radiation protection authorities to ensure uniform compliance across all facilities. Clinically, the results emphasize the importance of ongoing staff training and awareness programs to maintain safe radiological practices and minimize occupational exposure.

V. CONCLUSION

Based on the empirical evidence generated from this study, it is concluded that radiation protection measures are generally implemented across both government and private radio-diagnostic facilities in Port Harcourt Metropolis. The findings indicate a reasonable level of compliance with radiation safety principles among radiology personnel.

However, the presence of significant inter-facility variations in radiation protection measures suggests inconsistencies in equipment maintenance practices, and operational adherence to radiation safety protocols.

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