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EVALUATION OF COMPLIANCE, KNOWLEDGE , ATTITUDE, PREVENTION PRACTICE AND EFFECTIVE USE OF RADIATION SAFETY GADGETS AMONG HEALTHCARE STAFF IN RADIOLOGY AND RADIO-ONCOLOGY DEPARTMENTS IN DAVID UMAHI FEDERAL UNIVERSITY TEACHING HOSPITAL, UBURU.

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ABSTRACT:
BACKGROUND: Radiation medicine is a critical tool in medical diagnosis and cancer therapy, yet it poses significant health hazards to healthcare personnel when not properly controlled. The use of ionizing radiation in medical practice raises concerns about radiation safety and the associated risks of exposure. Ionizing radiation can damage living tissue and increase the risk of cancer and other adverse health effects. In many Nigerian hospitals, anecdotal reports and preliminary audits have indicated poor adherence to radiation safety protocols and irregular use of protective gadgets. Evaluating both compliance and effectiveness of these gadgets will provide evidence to improve occupational safety policies, staff training, and radiation protection culture
OBJECTIVE OF STUDY: To evaluate the compliance and effectiveness of radiation safety gadgets among healthcare staff in radiology and radio-oncology departments
METHODOLOGY:A Cross-sectional descriptive study that assessed the knowledge , attitude , practice and availabilitry of radiation saftty gadgets in prevention of radiation exposure among staffs of radiology and radio-oncology departments of David Umahi federal university teaching hospital, Uburu, Ebonyi state.
RESULT: A total 99 participants bearing 57 males and 42 females between the ages of 20 to 40 years participated in those research with majority of the participants 45.5% (45) belonging to radio-oncology department comprising of radiologists, radio-oncologists, radiographers/technologist medical physicists, nurses and technician**.** DUFUTH radiation workers have good knowledge on radiation, its exposure, safety and its danger. Many of the have poor attitude toward safety prevention in radiation unit, poor prevention practice on radiation exposure as many do not wear their protective device due to non availability of safety gadgets, lack of institutional control and enforcement of safety rules, absence of safety policy by the department and management and lack of training and retraining of radiation staff on radiation exposure prevention practice**.** Finally most of the safety gadgets are not available, not adequate and in areas where they are available they are not in good condition.
CONCLUSION: Healthcare organizations must adopt a culture of safety, enhance education and training for healthcare professionals, and provide sufficient resources to support radiation safety practices. By implementing these measures, healthcare organizations can ensure that radiation safety practices are consistently implemented, improving patient care and enhancing the safety of healthcare professionals working with radiation.

I. INTRODUCTION

Radiation medicine is a critical tool in medical diagnosis and cancer therapy, yet it poses significant health hazards to healthcare personnel when not properly controlled. Radiologists, radio- oncologists, radiographers, nurses, and physicists in radiology and radio-oncology departments are routinely exposed to ionizing radiation.However, the use of ionizing radiation in medical practice raises concerns about radiation safety and the associated risks of exposure. Ionizing radiation can damage living tissue and increase the risk of cancer and other adverse health effects [1]. Thus, it is essential to ensure that radiation doses are kept as low as reasonably achievable and that proper radiation safety protocols are followed to minimize radiation exposure to both patients and healthcare workers.International guidelines such as those by the international atomic energy agency (IAEA) and World Health Organization (WHO) mandate the use of radiation protection gadgets such as lead aprons, thyroid shields, lead glasses, and dosimeters to minimize exposure. However, compliance levels vary across healthcare facilities, especially in low- and middle-income countries where resource constraints and limited awareness persist [1]

In many Nigerian hospitals, anecdotal reports and preliminary audits have indicated poor adherence to radiation safety protocols and irregular use of protective gadgets. Evaluating both compliance and effectiveness of these gadgets will provide evidence to improve occupational safety policies, staff training, and radiation protection culture [2, 3]

Previous studies have demonstrated that healthcare workers exposed to radiation may suffer deterministic and stochastic effects when safety standards are not maintained [4] .Compliance with personal protective equipment (PPE) use has been reported as suboptimal in several low-resource settings. Factors influencing compliance include availability of gadgets, staff knowledge and attitude, institutional enforcement of safety policies, regular monitoring (dosimetry), and maintenance of equipment.

Effectiveness of gadgets depends on the quality of materials (e.g., lead equivalence), frequency of inspection, and correct use [5]. Regular radiation monitoring through personal dosimeters and area surveys is essential to evaluate effectiveness and ensure exposure remains below permissible limits [6].

In a research done in radio-diagnostic and medical imaging department, Prince Sultan Military Medical City, Riyadh, Saudi Arabia, findings showed revealed statistically significant differences in the grading system results among various groups of respondents, based on their educational level. Also, there are statistically significant differences between the assessments of safety level results in the answers provided by various groups of respondents according to education level in favor of the master's degree [7][8]. The health, safety, and wellness of healthcare practitioners and patients rely on the successful implementation of workplace safety policy and professional code of conduct. Technological advancements in the healthcare sector have enabled the use of various systems [9] [10]. However, studies have shown that there is still a need for improved radiation safety awareness and practices among radiology technologists and other healthcare professionals [11]. In addition, new technologies, such as interventional radiology, present unique radiation safety challenges that require specialized training and protocols. Therefore, ongoing research and education on radiation safety are critical to ensure that healthcare professionals can safely and effectively use radiography and imaging technology to support patient care [11].

The International Commission on Radiological Protection (ICRP) has established principles for radiological protection in medicine, emphasizing the need to balance the benefits of radiation exposure with the potential risks. The ICRP has recommended that healthcare professionals take steps to reduce radiation exposure by using appropriate shielding, selecting appropriate imaging modalities, and implementing imaging protocols that minimize radiation doses. These guidelines are critical in ensuring patient and staff safety while maintaining the quality of diagnostic information obtained through radiography and imaging technology [11].The use of CT has increased dramatically in recent years, leading to concerns about the potential health risks associated with radiation exposure. Many studies conducted estimated the increased risk of cancer associated with the increased use of CT and it was found that CT scans were responsible for an estimated 1.5-2% of all cancers in the United States with an estimated risk of developing cancer from CT scans increases with repeated exposure [12]. The Royal College of Radiologists (RCR) has published guidance on radiation dose limits in the UK, which provides recommendations on appropriate radiation dose levels for various imaging modalities. These guidelines emphasize the importance of optimizing radiation dose and reducing unnecessary radiation exposure [13]. The National Council on Radiation Protection and Measurements (NCRP) has also published a report on ionizing radiation exposure of the population of the United States, which provides an overview of the sources and levels of radiation exposure in the United States. This report highlights the need for continued research and collaboration to optimize radiation dose and reduce radiation exposure in clinical practice [14]

Based on the findings from the study, several important implications can be drawn for the practice of radiography and imaging technology, the research project is of significant importance to the healthcare industry and has the potential to improve radiation safety practices in radiography and imaging technology. By gathering data from a diverse sample of healthcare professionals, the study aims to provide valuable insights into current practices and inform the development of guidelines and recommendations for improving radiation safety practices.

RESEARCH QUESTIONS

1. What is the level of compliance with radiation safety gadget use among healthcare staff in radiology and radio-oncology departments
2. What factors influence compliance with radiation safety protocols?
3. How effective are the available radiation safety gadgets in reducing exposure to ionizing radiation?
4. What institutional and individual barriers hinder optimal use of radiation protection gadgets?

OBJECTIVES

General Objective:

To evaluate the compliance and effectiveness of radiation safety gadgets among healthcare staff in radiology and radio-oncology departments.

Specific Objectives:

1. To determine the social demographic status of staffs of radiology and radio-oncology department in DUFUTH.
2. To determine the knowledge of staff on exposure
3. Attitude of staffs and management toward radiation exposure prevention.
4. Practice of staff and management towards prevention of occupational radiation exposure.
5. To assess the availability and adequacy of radiation safety gadgets in the departments
6. To make recommendations for improving radiation safety and staff protection.

METHODOLOGY

Study Design:

This is a Cross-sectional descriptive study combining questionnaire-based survey on radiation exposure assessment.

Study Area: Radiology and Radio-oncology Departments of David Umahi federal university teaching hospital, Uburu, Ebonyi state.

Study Population: These includes radiologists, radiographers, radiation oncologists, medical physicists, radiology nurses, and support staff of radiology and radio-oncology department of DUFUTH

Inclusion Criteria: Staff who have worked in the department for at least six months and consent to participate.

Exclusion Criteria: Temporary staff or interns with less than six months' experience.

Data	**Collection**	**Instruments**
1.	Structured	Questionnaire
2.	Observation	Checklist

Data Analysis: Data was analyzed using SPSS version 26. Descriptive and inferential statistics applied; significance set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the institutional ethics review board. Informed consent was obtained from participants. Confidentiality and anonymity was maintained. Data was used solely for research purposes.

Significance of the Study

Findings provides data on radiation protection practices, support hospital management and policymakers in improving safety standards, help reduce occupational radiation exposure risks, and contribute to national compliance with international safety guidelines.

II. RESULTS AND DISCUSSION

The number pf professionals in radiology and radio-oncology department in DUFUTH that participated in this research are 99 in numbers with 57 males and 42 females. All participants work in David Umahi Federal University Teaching Hospital and predominantly of South-East origin.

DEPARTMENT OF PARTICIPANTS.

Majority of the participants 45.5% (45) belong to radio-oncology department while the remaining staffs 41.4% (41) are from radiology department. Non resident staffs of radiology and radio-oncology department amounted to 13.1% (13) of the participants. Similar observation in Lagos, demonstrated a demographic profile with a gender distribution skewed towards females than males with female participants of 61.9% while 38.1% male

[15].Also participants are mainly from related departments of radiology and radio-oncology department respectively[15][16].

Table 1: Showing the distribution of participants by their departments.

DEPARTMENET	FREQUENCY	PERCENTAGE
RADIOLOGY	41	41.4
RADIO-ONCLOGY	45	45.5
OTHERS	13	13.1
TOTAL	99	`100

JOB TITLE

The diversity of the participants displayed a 5%(5) for radiologists, 2%(2) for radio-oncologists, 54.5%(54) for radiographers/technologists, 3.0%(3) for medical physicists, 18.2(18) for nurses, 4.0%(40) for Technicians and Assistants, 13.1(13) for other professionals in the health sectors as showed in table below.

In Lagos the dominant participant in similar research were doctors (23.8%) and physiotherapists (19.0%) [15] and 100 radiographers recruited in teaching hospitals (58%), general hospitals (19%) and private diagnostic centers' (23%) also in Lagos respectively (16). Similarly in Egypt, Radiographers and Radiologist top the participants in similar research study [17].

Table 2 : Showing the professional distribution of the participants.

JOB TITLE	FREEQUENCY	Percentage
RADIOLOGIST	5	5.0
RADIATION ONCOLOGIST	2	2.0
RADIOGRAPHER/TECHNOLOGIST	54	54.5
MEDICAL PHYSICIST	3	3.0
NURSE	18	18.2
TECHNICIAN/ASSISTANT	4	4.0
OTHERS	13	13.1
TOTAL	99	100

WORKING EXPERIENCE

Among the participants, 23.2%(23) have worked in the department for less than a year while 34.3%(34) have worked between 1-3years. 23.2%(23) have worked for 4-6 years and 19.2%(19) have worked between 7-10years in departments in radiology, radio-oncology and related departments in DUFUTH and beyond. No participant has had more than 10 years working exposure. In south Africa, Most participants in a similar research have 2 and 5 years of experience while some had 15 years of experience[18]. In Egypt, 39.3%, >3yrs, 26.8 %, 3->6yrs and 6 and more years stood at 33.9% [17] and of participants in Osun state Nigeria, (42.9%) have 1-5 years of experience in the field, suggesting that many are in the early stages of their careers [15]

Table 3: showing the years of experience of the participants.

YEARS	FREEQUENCY	PERCENTAGE
<1	23	23.2
1-3	34	34.3
4-6	23	23.2
7-10	19	19.2
>10	0	0
	99	100

HIGHEST QUALIFICATION

19.2% (19) possess diploma certificate among the participants while 38.4%(38) have MBBS/BSC degree. Those with MSC/MPH are 20.2%(20) while MD/PHD amounted to 22.2%(22).In south west Nigeria, 98% of respondents in similar research had good knowledge of radiation protection probably because of their academic qualifications to practice as qualified radiographer [16] and Egyptian studies revealed 50.52% with a bachelor's degree and 75% were nursing qualification[17].

Table 4: showing the educational qualification of participants

QUALIFICATION	FREQUENCY	PERCENTAGE
DIPLOMA	19	19.2

BSC/MBBS	38	38.4
MSC/MPH	20	20.2
MD/PHD	22	22.2
OTHERS	0	0
TOTAL	99	100

AVERAGE HOURS/WEEKS SPENT IN AREA WITH IONIZING RADIATION

Among the participants, 25.3% (25) of them have less than 10hours per weekly exposure to ionizing radiation, while 24.2% (24) has between 10-20 hours. 21.2% (21) have between 21-40 hours exposure while 29.3% (29) have over 40 hours weekly exposure to ionising irradiation in the course of their line job. Similar study shows 49.73% of the participants were exposed to X-rays, 39.3% in less than three years of dealing with radiation[17].However, exposure vary per department generally and annual dose limits exposure is a more reliable way of accessing radiation exposure for hospital workers rather than specific numbers of working hours[16][17]

Table 5: showing the average hours of exposure of participants to radiation per week.

AVERAGE HOURS PER WEEK	FREQUANCY	PERCENTAGE
<10	25	25.3
10-20	24	24.2
21-40	21	21.2
>40	29	29.3
TOTAL	99	

SECTION 2: ASSESMENT OF KNOWLEDGE (OBJECTIVE 2)

IONIZING RADIATION CAN CAUSE WHICH OF THE FOLLOWING

In knowledge assessment among participants, 29.3% (29) believed ionising radiation can cause skin burns while 36.4%(36) believed it can cause cancers. 34.3% (34) believed it can cause genetic defects. Similar studies demonstrated an important understanding of the varying risks associated with different imaging techniques, among participants despite lacking formal training[15][16]. Other studies showed that knowledge and compliance did not depend on years in practice according to Tilson [19] because out of 97% that had good knowledge of safety standards, 80% had less than 10 years in practice and majority were involved in continuing education [20, 21]. 70.1% and 60.4% of the studied health care workers marked the correct answers that skin abnormalities and bone marrow depression are radiation risks, respectively. However, 64.3% and 67.2% of the studied health care workers chose the wrong answers [17].

Table 6: showing the knowledge of participants on the damaging effect of radiation.

DISEASES	FREQUENCY	PERCENTYAGE
SKIN BURNS	29	29.3
CANCER	36	36.4
GENETIC DEFFECTS	34	34.3
NONE OF THE ABOVE	0	0
TOTAL	99	100

KNOWLEDGE ON APPROPRIATE PERSONAL DOSE LIMIT FOR OCCUPATIONAL EXPOSURE

Among the participants, 28.3%(28) believed that 1MSV exposure is an appropriate dose limit while 43.4%(43) believed a dose of 20MSV is appropriate. 28.3%(28) among the professionals do not know the required amount of dose exposure. Surprisingly, About 53.6%, 58.9%, and 74.7% of the participants in a similar study did not know the normal minimum safe distance from the X-ray machine while doing portable X-rays, the highest permissible amount of occupational radiation exposure, or that pregnant nurses cannot work in fluoroscopy in the first trimester [17]. 56.8% of the studied sample had poor knowledge about radiation exposure safety awareness [17] . Studies done in one of the countries in East African exposes that 47.14%, 43.5%, 36.2%, and 57% of the studied sample never used a dosimeter, did not follow dosimeter controls, did not wear a leaded apron, or did not wear a leaded collar[17]. Limit for occupational exposure was 50 mSv, in Ghana, reflecting familiarity and reasonable awareness of safety regulations and dose limits[22]. Generally, annual effective dose limit of 50mSv(5rem) for a whole body in the united state according to OSHA regulation is acceptable. However, annual average occupational limit of 20mSv(average for over 5yrs0 is recommended by international bodies like ICRP[17][22]

Table 7: showing the knowledge of participants on dose limit of occupational exposure of radiation

DOSE	FREQUENCY	PERCENTAGE
1MSV	28	28.3
20MSV	43	43.4
100MSV	0	0
DO NOT KNOW	28	28.3
TOTAL	99	100

WHICH GADGET PROVIDE EFFECTIVE PROTECTION TO THE THYROID

Participants responding to the questions, 25.2% (25) believed lead apron is effective in providing protection to the thyroid, while 48.5% (48) believe thyroid shield is more effective. 27.3% (27) believed lead glasses provide effective protection for the thyroid respectively. In Egypt, personal dosimeter was not available for 100% of the studied radiographers, 56% of them wear apron during work [23]. Also, 91% of the studied radiographers wear thyroid collar, while73% of them didn't wear eye protective, and 65% of them didn't wear gloves [23]

Table 8: showing participants knowledge on the gadget with maximal protection

GADGET	FREQUENCY	PERCENTAGE
LEAD APRON	25	25.2
THYROID SHIELD	48	48.5
LEAD GLASSES	27	27.3
NONE	0	0
DON'T KNOW	0	0
TOTAL	99	100

THE BEST PLACEMENT OF PERSONNEL DOSIMETER

Among the participants, 34.3% (34) believed dosimeter should be placed under the lead apron at the chest level while 29.3% (29) believed it should be over the apron at the collar level. 18.2% (18) believed it should be placed under the wrist and 18.2% (18) do not know where and how to place the dosimeter. In Egypt, study illustrated that; 46% of the radiographers had good knowledge score about radiation hazards and protective measures, while 30% of them had poor knowledge about radiation hazards and protective measures [23]. The best place to place dosimeter is on front of the body between the wrist and the neck(chest wall) facing the radiation source[29]

Table 9: showing the knowledge of participants on the correct placement of personal dosimeter

SITE	FEQUENCY	PERCENTAGE
UNDER THE LEAD APRON AT CHEST LEVEL	34	34.3
OVER THE APRON AT COLLAR LEVEL	29	29.3
ON THE WRIST	18	18.2
DON'T KNOW	18	18.2
TOTAL	99	100

HOW OFTEN SHOULD RADIATION PROTECTION EQUIPMENT (LEAD APRON, THYROID SHIELDS) BE INSPECTED FOR DEFECTS

Among the participants, 32.3% (32) believed radiation protection equipment should be inspected monthly, while 24.2% (24) believed it should be inspected every six monthly for defects.24.2% (24) believed it should be inspected annually while 21.2% (21) do not know the frequency of inspection. In Saudi Arabia, studies show, When it came to radiation safety training, only 23% of participants have undergone radiation safety training, whereas most have not been trained [24]. Similarly participants of this research also lack training and retraining on the use of these safety device and how often they can be expected and for defects. Depending on the facility, annual inspection is generally acceptable and practiced by most institution[24]

Table 10: showing the participants knowledge on the regular inspection of radiation protection equipment.

DURATION	FREQUENCY	PERCENTAGE
MONTHLY	32	32.3
EVEETY 6MONTHS	24	24.2
ANNUALLY	24	24.2
DON'T KNOW	21	21.2

TOTAL	99	100

SECTION 3: ASSESMENT OF ATTITUDE -(Objective 3)

USING RADIATION SAFTY GADGETS IS ESSENTIALLY FOR MY HEALTH

Among the participants, 100% of them believed that radiation safety gadgets are for their safety and health. Many research show strong correlation of knowledge of staffs and health workers on the importance of radiation safety gadgets in protection of health workers in radiation related departments.[15,16,17,18,19,20,21,22,23,24]

Table 11: showing the attitude of staff for their personal safety against radiation occupational exposure

ATTITUDE	Frequency	Percentage
STRONGLY AGREE	99	100
AGREE		
NONE		
DIAGREE		
STRINGLY DISAGRE	99	100

WEARING DOSIMETER IS INCONVEIENT AND UNNECSARY

Among the participant, 53.5% (53) strongly disagree that wearing of dosimeter is inconvenient and unnecessary while 23.2% (23) disagree, However, 23.2%(23) strongly agree that wearing of dosimeter is inconvenient and unnecessary. Comparatively, professionals in Saudi Arabia have a positive attitude and felt confident about the steps needed in radiation safety measures and thereby suggesting an overall substantial confidence perceived by those physicians about their skillfulness on radiation precautions[24].

Table 12: showing the participants attitude towards wearing of personal dosimeter.

ATTITUDE	Frequency	Percentage
STRONGLY AGREE	23	23.2
AGREE		
NONE		
DIAGREE	23	23.2
STRINGLY DISAGRE	53	53.5
TOTAL	99	100

MY DEPARTMENT ENFORCES RADIATION SAFETY RULES CONSISTENTLY

Among the participants, 38.4%(38) strongly agree that their departments in DUFUTH enforce safety rule concerning irradiation exposure while 29.3%(29) agree. However, 32.3% (32) disagree. In Pakistan, Staff in medicine demonstrated the highest proportion of good knowledge in safety rules with an indication in formal training, professional role, work experience, and departmental context significantly influence awareness of radiation protection and safety hazards[25].

Table 13: showing the management attitude towards prevention of occupational exposure at the departmental level

ATTITUDE	Frequency	Percentage
STRONGLY AGREE	38	38.4
AGREE	29	29.3
NONE	0	0
DIAGREE	0	0
STRINGLY DISAGRE	32	32.3
TOTAL	99	100

I FEEL SAFE FROM OCCUPATIONAL RADIATION AT WORK

32.2% (32) strongly disagree concerning their safety working in their departments in DUFUTH while 15.2% (15) disagree. However, 17.2% (17) strongly agree that they feel safe from occupational radiation exposure at work and 20.2% (20) agree and 15.2% (15) neither agree nor disagree on their safety. Studies in Palestine revealed a current investigation level of inadequate knowledge of radiation protection and safety (40.5%) of the radiographers and they admitted seldom received any training about radiation protection. While only (2.7%) of them reported that they regularly attended such training. and (27.0%)[26]. Results show that the radiographers involved in this study lacked sufficient understanding on radiation protection and safety and consequently a higher percentage feel unsafe in their work environment. This could also be due to inadequate provision of safety gadgets, lack of training on safety rules

and how to use available gadget and lack of will power of the management to implement safety rules. In Pakistan Most participants had poor knowledge (43.3%), while 40.7% showed good and 16.0% average knowledge. Institutional training strongly predicted higher knowledge scores [27]

Table 14: showing the feeling of participants toward their own safty concerning occupational radiation exposure.

ATTITUDE	FREQUENCY	PERCENTAGE
STRONGLY AGREE	17	17.2
AGREE	20	20.2
NONE	15	15.2
DISAGREE	15	15.2
STRONGLY DIAGREE	32	32.2
TOTAL	99	100

SECTION 4 (practice, objective 4).

HOW OFTEN DO YOU WEAR LEAD APRON WHEN INDICATED

Among the participants, 29.2% (29) often wear their lead apron always as indicated while 16.2% (16)often wear their apron frequently or often. 18.2% (18) wear their lead apron occasionally while 16.2% rarely wear their lead apron. 20.2% (20) never wear their led apron. Similar studies done in Sirilanka, though the usage of certain radiation protection gears was poor initially, there became a significant increase in usage noted after the intervention (p-0.0534). The knowledge of the safety principle significantly improved after the health education programme (p-0.0474). In addition to that, awareness of the adverse effects of radiation also has been significantly enhanced after the intervention (p-0.0253).Radiation safety awareness is poor among nursing officers in most setting compared to other radiation workers [28]. In Saudi Arabia, findings indicated a pervasive insufficiency in the understanding of radiation safety principles among ICU personnel across various disciplines. Such deficiencies in knowledge can impede adherence to safety standards and elevate risks. Additionally, the review highlights the concerning cumulative radiation effective doses received by ICU patients from frequent diagnostic imaging, which sometimes surpasses recommended limits and consequently heightens the lifetime risk of cancer [29]. Similarly in cohcrane, the results indicated that in most studies, more than half (50%) of the participants had average knowledge. Furthermore, 60% of the participants had a positive attitude, but in most studies, they had average practice regarding radiation protection [30].

Table 15: showing the frequency of participants wearing lead Apron

WEAR APRON	FREQUENCY	PERCENTAGES
ALWAYS	29	29.2
FREQUENTLY/OFTEN	16	16.2
SOMETIMES/OCCASIONALLY	18	18.2
RARELY/SELDOM	16	16.2
NEVER	20	20.2
TOTAL	99	100

HOW OFTEN DO YOU USE THYROID SHIELD WHEN INDICATED

Among the participants, 36.2% (36) always use the thyroid shield while 16.2% (16) frequently use their thyroid shield. 16.2% (16) sometimes use their thyroid shield while 15.2%(15) rarely use their thyroid shield. 16.2% (16) never use their thyroid shield. This show a higher percentages of staff wearing their thyroid shield during procedures in DUFUTH, a positive and commendable practice. In Egypt, a significant positive correlation between knowledge score and practice score of participants was obtained in similar research, conclusion reached was that radiation safety knowledge and practice of participants were poor [31]. In Trinidad , participants' knowledge regarding the proper positioning of the C-arm image intensifier to reduce radiation exposure was low with 46% of individuals providing a correct response. Dosimeter badges were owned by 42% (49/118), of which only 60% (30/49) used them regularly. The frequency of using a radiation dosimeter badge was found to be dependent on the department under which the participant was employed [32]. In Indian, The results indicated that more than 60% of the health care workers had a positive attitude about adhering to radiation protection precautions [33].

Table 16 showing the frequency of participants wearing thyroid shield

THYROID SHIELD	FREQUENCY	PERCENTAGES
ALWAYS	36	36.2
FREQUENTLY/OFTEN	16	16.2

SOMETIMES/OCCASIONALLY	16	16.2
RARELY/SELDOM	15	15.2
NEVER	16	16.2
TOTAL	99	

HOW OFTEN DO YOU WEAR LEAD GLASSES DURING FLUOROACOPIC PROCEDURES

Among participants, 22.2%(22) wear their lead glasses during fluoroscopic procedures always while 19.2%(19) wears occasionally and 18.2%(18) wears rarely and 40.4%(40) never wears. This shows that higher percentage of staff of DUFUTH do not wear lead glasses during procedure thereby exposing their eyes to radiation. This is not a good practice and radiation exposure must be curtailed.

Table 17; showing the frequency of participants wearing lead glasses

LEAD GLASSES	FREQUENCY	PERCENTAGES
ALWAYS	22	22.2
FREQUENTLY/OFTEN		
SOMETIMES/OCCASIONALLY	19	19.2
RARELY/SELDOM	18	18.2
NEVER	40	40.4
TOTAL	99	100

HOW OFTEN DO YU WEAR YOUR PERSONAL DOSIMETEER WHILE ON DUTY

Among participants, 18.2% (18) wears their personal dosimeter always while 15.2% (15) wears frequently. 15.2% (15) wears occasionally while 14.2%(14) wears seldom. 37.2% (37) never wears. This shows that higher percentage of staffs in radiology and radio-oncology department in DUFUTH do not wear personal dosimeter despite their adequate knowledge of its usefulness in safety protection in radiation unit.

Table 18: showing the frequency of participants wearing personal dosimeter

DOCIMETER	FREQUENCY	PERCENTAGES
ALWAYS	18	18.2
FREQUENTLY/OFTEN	15	15.2
SOMETIMES/OCCASIONALLY	15	15.2
RARELY/SELDOM	14	14.2
NEVER	37	37.2
TOTAL	99	100

HOW OFTEN DO YOU CHECK DOSIMETER READING OR EXPOSURE REPORTS

Among participants, 20.2% (20) check their dosimeter reading exposure reports always while 18.2% (18) check occasionally. 18.2% (18) check rarely while 43.3%(43) never fcheck. Again higher percentage of staff do not check nor read the dosimeter for exposure even among the few that wear at work.

Table 19: showing the frequency of participants checking the readings of dosimeter

DOCIMETER	FREQUENCY	PERCENTAGES
ALWAYS	20	20.2
FREQUENTLY/OFTEN		
SOMETIMES/OCCASIONALLY	18	18.2
RARELY/SELDOM	18	18.2
NEVER	43	43.3
TOTAL	99	100

HOW OFTEN DO YOU STEP OUT OF ROOM /BEHIND SHIELD DURING EXPOSURES (WHEN POSSIBLE)

Among participants, 31.2% (31) always step out of the room behind shield during exposure while 16.2% (16) step out often. 17.2% (17) step out occasionally and 17.2% (17) seldom step out and 18.2%(18) never step out. Surprisingly, higher percentages of staff in DUFUTH practice this safety measure regularly by stepping out radiation zone whenever possible during procedures.

Table 20: showing the frequency of participants stepping of out exposure during procedure

DOCIMETER	FREQUENCY	PERCENTAGES
ALWAYS	31	31.2
FREQUENTLY/OFTEN	16	16.2
SOMETIMES/OCCASIONALLY	17	17.2
RARELY/SELDOM	17	17.2
NEVER	18	18.2
TOTAL	100	100

SECTION 5 : ASSEMENT OF AVAILABILITY OF SAFTRY GADGETS
BARRIERS AND SUGGESTION
IF YOU SOMETIMES OR RARELY USE PROTECTIVE GADGETS, WHAT ARE THE REASONS?
On the reason why people rarely use protective device, 34.2(34) do so because its not available while 16.2(16) do so because protective gadgets are damaged or in poor condition. 17.2% (17) do so because they interferes with work while 16.2%(16) do so because there is no enforcement. 16.2%(16) do so for other reason. The main reason why protective gadgets are not used in DUFUTH is because they are not available, higher percentage of staff stated that as their reason, unfortunately, 16.2% do not have a concrete reason why they don't use protective device. Others stated the device available are not in good condition

Table 21: showing the various reason for failure to use radiation saftry device in DUFUTH.

REASONS	FREEQUENCY	PERCENTAGE
NOT AVAILABEL	34	34.2
DAMAGED/POOR CONDITION	16	16.2
UNCOMFORTABLE		
INTERFERS WITH WORK	17	17.2
NO ENFORCEMENT	16	16.2
LACK OF TRAINING/KNOWLEDGE		
OTHERS	16	16.2
TOTAL	99	100

WHAT WOULD IMPROVE YOUR USE OF RADIATION SAFETY GADGETS
On the suggestions for the increase use of safety gadgets, 27%(27) suggest availability while 11%(11) request for training and 10%(10) request for knowledge to improve usage. Availability and enforcement stood at 10%(10) while awareness stood at 10%(10). Availability and education stood at 10%(10) while availability and good education stood at 10%(10). Availability and good condition stood at 10%(10) while availability and training stood at 11(11%). On this , availability, training and institutional enforcement of safety rules top the reasons and suggestions for improvement in the usage of radiation safety device in DUFUTH.

Table 22: showing participants suggestions for improve usage of safety device.

IMPROVE RADIATION USE.	FREQUENCY	PERCENTAGE
Knowledge	10	10%
Availability and enforcement	10	10%
Awareness	10	10%

Availability, education-	10	10%
Availability and good condition	10	10%
Training	11	11%
Availability and training	11	11%
Availability	27	27%
TOTAL	99	100%

B. OBSERVATION CHECK LIST –COMPLIANCE AND EQUIMENT CONDITION

ARE STAFF WEARING LEAD APRONS WHEN IN THE EXPOSURE AREA

On the knowledge of wearing led apron in expose area, 41.4% (41) agreed that staff wear lead apron when in expose area while 25.2%(25) said No and 33.4%(33) says not available. Higher percentage agreed yes , followed by not available on the question whether staff wears lead apron during procedures.

Table 23: showing answers to staff wearing lead apron during procedures.

EXPOSURE AREA	FREQUENCY	PERCENTAGE
YES	41	41.4
NO	25	25.2
NA	33	33.4
TOTAL	99	100

ARE THYROID SHIELD USE BY STAFF WHEN INDICATED

Among participants, 46.5%(46) agreed to thyroid shield being used when indicated while 26.2%(26) said No and 27.3%(27) said not available. Higher percentage of staff in DUFUTH wear thyroid shield when indicated during procedure.

Table 24: showing answers to staff wearing thyroid shield during procedures.

THYROID SHIELD	FREQUENCY	PERCENTAGE
YES	46	46.5
NO	26	26.2
NA	27	27.3
TOTAL	99	100

ARE LEAD GLASSES USED DURING CLOSE FLUOROSCOPY /ANGIO PROCEDURES?

Among participants, 32%(32) agreed that lead glasses are used by staff during close fluoroscopy? Angio procedures, while 30% said NO and 38%(38) said not available. Higher percentage of participants said lead glasses are not available therefore they are nor worn during fluoroscopy.

Table 25: showing answers to staff wearing lead glasses during fluoroscopy procedures.

Lead glasses	FREQUENCY	PERCENTAGE
YES	32	32
NO	30	30
NA	38	38
TOTAL	99	100

ARE PERSONAL DOSIMETER VISIBLY WORN IN APPROPRIATE POSITION

Among participants, 36.4%(36) said personal dosimeters are visibly worn in appropriate position while 32.3%(32) said NO and 31.3%(31) said its not available. Higher number of participants wear personal dosimeter in appropriate positon

Table 26: showing answers to staff wearing dosimeter in appropriate position

DOSIMETER	FREQUENCY	PERCENTAGE
YES	36	36.4
NO	32	32.3
NA	31	31.3
TOTAL	99	100

ARE DISTANCING AND SHIELDING MEASURES USED (LEAD SCREENS, MOBILE SHIELDS)

Among participants, 44.4%(44) said lead screens and mobile shields are used when necessary while 26.3%(26) said NO and 29.3(29) said not available. Higher percentages of participants agreed that distancing and shielding measures are used during procedures in DUFUTH.

Table 27: showing participants answers to using distancing and shielding, measures during procedures.

DISTANCING	FREQUENCY	PERCENTAGE
YES	44	44.4
NO	26	26.3
NA	29	29.3
TOTAL	99	100

IS THERE VISISBLE SIGNAGE INDICATING RADIATION AREA/MANDATORY PPE

On the question of visible signage in dictating radiation area, 42.2% (42) said yes while 28.3% said No and 29.3%(29) said not available. Higher percentages agree that signage indication are present in visible areas.

Table 28: showing answers to presence of visible signage indication in radiology department

SIGNAGE	FREQUENCY	PERCENTAGE
YES	42	42.4
NO	28	28.3
NA	29	29.3
TOTAL	99	100

ARE STAFF STEPPING OUT BEHIND CONTROL AREA /BEHIND SHIELD DURING EXPOSURE

Among the participants, 43.4%(43) said yes to staff stepping out behind the control area while 26.3%(26) said No to it. 30.3%(30) said Not available. Higher percentage agreed that staff step out behind control areas during procedures.

Table 29: showing answers to staff stepping out behind control area during procedures.

CONTROL AREA	FREQUENCY	PERCENTAGE
YES	43	43.4
NO	26	26.3
NA	30	30.3
TOTAL	99	100

IS THE LEDAD APRON PRESENT AND APPEAR INTACT

Among participants, 57.6%(56) said yes to lead apron been present and intact while 42.4%(42) said No.

Table 30: showing the respondent answers to presence of lead apron.

LEAD APRON	FREQUENCY	PERCENTAGE
YES	56	57.6
NO	42	42.4
TOTAL		
TOTAL	99	100

ARE THYROID SHIELD IN GOOD CONDITION

Among participants, 56.7% (56) said yes to thyroid shield been in good condition wile 43.3% said No.

Table 31: showing respondent on the condition of thyroid shield

THYROID SHIELD	FREQUENCY	PERCENTAGE
YES	56	56.7
NO	43	43.3
TOTAL	99	100

IS THERE EASY ACCESS TO SPARE PROTECTIVE GADGETS

On the question on easy access to the spare protective device, 51.7% (51) said yes while 48.3% said No.

Table32: showing respondent on easy access t spare parts of safety gadgets

EASY ACCESS	FREQUENCY	PERCENTAGE
YES	51	51.7
NO	48	48.3
TOTAL	99	100

ARE DOSIMETER STORAGE & RETURN PRACTICES APPROPRAITE?

On the question on the storage and return of dosimeter, 49.3% (49) said yes while 50.7% said no.

Table 33: showing respondent answers on storage and return of dosimeter.

EASY ACCESS	FREQUENCY	PERCENTAGE
YES	49	49.3
NO	50	50.7
TOTAL	99	100

No participant observed any safety hazard in the department.

Any immediate safety hazard observed.

No

III. SUMMARY OF RESULT

ON KNOWLEGDE

General finding indicated that DUFUTH radiation workers have good knowledge on radiation, its exposure, safety and its danger. Many of these knowledge were acquired form higher institution and their previous working places not necessarily in DUFUTH.

ON ATTITUDE

A greater percentage of staff of radiation and radio-oncology department in DUFUTH have poor attitude toward safety prevention in radiation unit. Many do not make conscious efforts to prevent exposure and many are not serous about radiation exposure prevention

ON PRACTICE

DUFUTH staffs of radiology and radio-oncology department have poor prevention practice on radiation exposure as many do not wear their protective device even when its available. These are largely due to non availability of safety gadgets, lack of institutional control and enforcement t, absence of safety policy by the department and lack of training and retraining g of radiation staff on radiation exposure prevention practice.

It is largely noted that most of these safety gadgets are not available and in areas where they are available they are not adequate or not in good condition.

IV. DISCUSSION.

Radiation safety awareness is crucial in healthcare to safeguard both patients and staff from ionizing radiation hazards [15][32][33] These results indicate that radiation safety practices in radiography and imaging technology are not uniformly implemented across different healthcare settings. Some radiographers appear to have insufficient knowledge of radiation safety practices, leading to non-compliance with established protocols. Findings in Ibadan revealed a mixed landscape of knowledge and practices, indicating both strengths and significant areas for improvement [15] with foundational awareness of radiation safety among staff. Most participants demonstrated basic knowledge of key concepts, such as the importance of maintaining distance and minimizing time to reduce radiation exposure, as well as recognition of common safety symbols [15] similarly in this study on knowledge assessment among participants 29.3%(29) believed ionising radiation can cause skin burns while 36.4%(36) believed it can cause cancers. 34.3%(340 believed it can cause genetic defects and surprisingly, participant demonstrated a great knowledge on dose limit exposure, necessary gadget for protection against irradiation with

good knowledge on how to wear these safety gadgets. However, some respondents perceive these safety measures and gadgets to be inadequate and largely unavailable in mitigating the risks associated with radiation exposure.

Most professional staffs in radiology and radio-oncology center requires training retraining on the use of these safety measures , gadgets and also the danger of non adherence for radiographers and other healthcare professionals working with radiation.

Findings in this research shows majority of the participants have the following suggestions as a way of improving the usage and availability of safety gadgets. 27%(27) suggest availability while 11%(11) request for training and 10%(10) request for knowledge to improve usage. Availability and enforcement stood at 10%(10) while awareness stood at 10%(10). Availability and education stood at 10%(10) while availability and good education stood at 10%(10). Availability and good condition stood at 10%(10) while availability and training stood at 11(11%).

Studies in south west on compliance revealed high compliance rate in majority of radio diagnostic centers located in south west Nigeria. Radiographers working in both private and public establishments in south west, Nigeria were been monitored and they strictly followed the radiation protection standard rules to be within radiation workers dose limits [16], similarly this studies show an encouraging culture of compliance among professional staff in DUFUTH although some of the gadgets like lead googles are not available for use.

Healthcare organizations should also ensure that sufficient resources are available to support radiation safety practices, such as providing adequate staffing levels and appropriate personal protective equipment. Furthermore, healthcare organizations need to adopt a culture of safety to promote radiation safety practices. A culture of safety can be fostered through regular safety audits, feedback mechanisms, and open communication between healthcare professionals. A culture of safety can help to ensure that radiation safety practices are consistently implemented and can prevent complacency and errors.

V. CONCLUSION,

Overall findings indicate that radiation safety practices in radiology and radio-oncology units in David Umahi Federal University Teaching Hospital needs to be improved to minimize the risks associated with radiation exposure. Healthcare organizations must adopt a culture of safety, enhance education and training for healthcare professionals, and provide sufficient resources to support radiation safety practices. By implementing these measures, healthcare organizations can ensure that radiation safety practices are consistently implemented, improving patient care and enhancing the safety of healthcare professionals working with radiation.

RECOMMENDATION

1. Radiation safety protocols need to be established as none is available in DUFTH, this will reflect evidence-based practice and go a long way in preventing staff from radiation exposure.
2. There is need for adequate provision and continuous maintenance of radiation safety gadget in DUFTH.
3. Adequate training and retraining of staff on the knowledge attitude and practice and usage of theses safety gadget is urgently recommended.
4. DUFUTH management need to step up in the enforcement of radiation safetry rules where necessary.

CONFLICT OF INTEREST:

The authors declare no conflict of interest.

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