Knowledge and Practice of Radiographers and Medical Radiology Technologist toward Radiation Protection a case of East Harerge zone, Dire Dawa city, and Hareri Region Hospitals,Ethiopia

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Abstract: Background: Occupational radiation protection is a necessity whenever radiation is used in the practice of medicine. Occupational radiation protection measures are necessary for all personnel who work in the diagnostic imaging departments. Ensure compliance with regulatory or generally accepted dose limits. So the level of awareness concerning radiation protection influences the behavior and practice of radiographers toward radiation protection. If they do have not enough awareness related to the mentioned issue, their action will not be safe and result in adverse effects. **Objectives:** To assess the knowledge and Practice of Radiographers and Medical Radiology Technologist toward radiation protection in the case of hospitals located in the Eastern Hareregе zone, Hareri Region, and Dire Dawa city. Methods: A facility-based cross-sectional study was conducted and a Convenient sampling method was used to collect data from the study site 75 radiographers were interviewed were on job during the data collection period. **Result:** The result of this study showed that 58.66 % of radiographers had good knowledge of radiation protection. 38.66%of them score well on radiation protection practice. The majority of them know the health effect of ionization radiation which are 97.3%. Only 16% of radiographers have a personal dosimeter and 13.3% are wear it regularly. 9.3% are getting refreshment courses toward radiation protection. 62.7% of them admitted the presence of personal protective equipment (lead apron, Gonad shields, etc.) in their facility**. Conclusion:** current level of radiation protection practice of Radiographer and Medical Radiology Technicians were inadequate. Specific actions such as regular training must be considered to assure their safety and patient safety during the radiological examination. There are inadequate radiation protection devices and monitoring in most of the hospitals in this study area. Further studies with a larger sample size are needed.

Keywords: Ionizing radiation; Knowledge; Medical imaging Practice; Radiography; Radiographrs; Radiation Protection.

Introduction

Radiation is a component of man's physical environment and is broadly classified into ionizing and non-ionizing radiation depending up on their energy to cause chemical changes to matter they interact. Ionizing Radiation is the most commonly used form of radiation in medicine for diagnostic and therapeutic purpose. Ionizing radiation has become one of the precise and powerful diagnostic tools in medicine. Nowadays, about 30-50% of medical decisions, especially in critical cases, are made based on radiology examinations [1].X-ray is type of ionizing radiation which used widely in medicine starting from his discovery by William Rontgen since 1905.Convectional X-ray machine, Fluoroscopy, Mammography and Computer Tomography, uses X-ray for medical imaging purposes as well as the most energetic form use for therapeutic purpose. Human being 80% of exposure to ionizing radiation comes from natural sources which is Radon gas and the most significant, while the other 20% comes from man-made radiation sources. Primarily medical X-ray contribute 90 % of ionizing radiation exposure from the whole man-made, with particular reference to MDCT alone accounts for about 50 % of the overall medicinal sources[2]. The average radiation dose received annually by the public is 2.5 mSv, and 15% of them are related to medical exposures [3I]. The use of ionizing radiation in medicine enhancing highly since introduction of new ionizing radiation oriented diagnostic and therapeutic practice. Although all medical interventions have potential benefits, it's potential risks should not be ignored. Higher the magnitude of dose on any exposure to the ionizing radiation able to induce stochastic effects which causes chemical changes in cells and damage them, as a result some cells may die or become abnormal and impacted for cancers and hereditary disorder and may effects on the gastrointestinal system, central nervous system, gonads or even whole body. These effects may appear as a somatic effect or in next generation as a genetic effect. Dose-dependent effects know as deterministic effects such as burn, erythema and teratogenic effects [5]. It is estimated that 20% of medical X-ray examinations are not beneficial, and that these and other unnecessary exposures leads to 100-250 cases of cancer each year in the UK [1] It is more than 100 years since the first usage of X-ray. In the early days of its implementation, there was no vision about its potential harms including various dermatomes, cataract, hematological disorders, and cancer which necessitates considering radiation protection strategies such as the 'as low as reasonably achievable' (ALARA) principle. For all medical imaging procedures, there are three basic principles: justification, optimization, and dose limits. The optimization concept has been refined as a result of increasing knowledge about radiation effects. Radiation protection P has been one of the main concerns since the early days of radiography and as the technology of medical imaging is continuously under revolution, the regulations needed for its safe usage is an important issue [6]. The International Commission on Radiological Protection (ICRP) is the primary body in protection against ionizing radiation. ICRP is working to advance for the public benefit the science

of radiological protection and began to develop the risk/benefit concept since 1977. This concept recommended that all patient exposures must be justified and kept as low as possible. So it is a mandatory issue to follow the ALARA principle during any examination [7]. Occupational exposure is the result of radiation exposure at work. Occupational radiation protection is necessity whenever radiation is used in the practice of medicine. Occupational radiation protection measures are necessary for all personnel who work in the diagnostic imaging departments ensure compliance with regulatory or generally accepted dose limits. The amount of absorbed dose is related to exposure factors such as kV/ potential difference and mA/ intensity of the beam and time. Personnel protection device and working in the safe construction decrease personnel exposure dose[5]. All workers require appropriate monitoring continuously by common personnel dosimeters like film badge and thermo luminescence dosimeter and it is an important tool to ensure compliance with regulatory or generally accepted dose limits [6]. Radiography is an essential diagnostic tool of modern medicine. Within a hospital, radiologists, radiology and nuclear medicine technicians, and others involved in the performance of x-ray and computed tomography (CT)scan examinations, have an increased risk for radiation exposure than the general hospital population[5]. Radiographers are one member of the medical team that deals with ionizing radiation. They are the key personnel involved in radiation exposure because they play a central role as they care for the patient before, during, and after the radiographic examination and/or radiological intervention. Within a hospital, Radiographers have an increased risk for radiation exposure than the general hospital population due to long time exposure to the radiation source [6]. Radiographers need to be more aware of their roles in ensuring total compliance to standard radiation safety in their institution. Awareness and knowledge on application protection guidelines and instruments among radiology technicians have ant role in safe working [7.] Monitoring of radiation doses received by staff in radio-diagnostic centers is of great importance to the radiographers in their effort to protect themselves, patients, and the general public from the unwanted effect of excessive radiation [6]. Moreover, the development and refinement of basic safety standards have a great important role to protect radiology staff. They must also receive education and training appropriate to their jobs and protect by tools and equipment's [4]. Assessment of baseline knowledge of radiation hazards and radiation protection practices of special groups at risk is essential in designing appropriate strategies for the prevention of unnecessary exposure to ionizing radiation not only among health workers but their patients also[10].So the level of awareness concerning with radiation protection influence behavior and practice of radiographer toward radiation protection. If they have not enough awareness related to mentioned issue, their action will not be safe and resulted to adverse effects [8]. Since Ethiopia follows investment promoting policy, the establishment of medical facilities is growing in number and type. Medical applications using ionizing radiation for diagnostic purpose are part of those facilities. As a result, human resource, quality control, protective device supply, maintenance and support service ought to have grown with the increasing number of facilities. But the poor status of the country economy may have its impact on them. Ethiopia became member of IAEA and in 1993 Ethiopia Radiation Authority established with aim of control and regulate the import, export, use, transport and dispose of any source of radiation with the country. The use of diagnostic imaging modalities in Ethiopia rise dramatically, conventional x-ray machines and ultrasound almost availed in all hospitals but MRI, CT scans, Fluoroscopy and Mammography are rare, only present in higher private hospitals and a few government hospitals. However, the availability and quality of this service are still poor, and also there is a lack of literature that shows the status. This can be ratified with the survey carried out in Addis Ababa public hospitals. Radiation safety for patients, staff, and the public around is inadequate level[10] . There is no study regarding this in the eastern part of the country. Therefore, this study aims to assess the knowledge and Practice of radiographers and Medical Radiology Technologist toward radiation protection a case of hospitals found in Eastern Hareregе zone, Hareri region and Dire Dawa city.

Statement of the Problem

The effects of low level exposure to ionizing radiation are of a concern to large number of people. Radiation work has the potential to present these harmful effects of radiation. Radiographers are one of the most exposed groups of workers for radiation and significant contributors to the entire collective doses. From an internal dose measurement perception due to the nature of their work, radiographers are pointed out as being more at risk for internal contaminations. Thus Personal protection devices is an important way to address the ALARA requirement in radiography. However, its use relies on the knowledge of radiographer and consistently adherence to professional conduct requirements relating to the application of protection devices especially for lead apron, thyroid shield, gonad shield, radiation sign, lead glove and lead goggles Awareness and knowledge of application protection guidelines and instruments among radiology technicians is vital to ensure a safe workplace. Compliance with work and safe radiation protection practices can reduce these risks. The protective measures provided are implemented, to ensure that the risks associated with the use of diagnostic ionizing radiation can be reduced. In eastern part of Ethiopia there is no data regarding this area. Thus this research intended to answer the question, regarding on radiographer's level of knowledge on radiation protection and their personal practice toward radiation`protection.

Literature Review

Radiation is energy that propagates through space or matter in the form of wave or particle. X-ray, light, infra-red are examples of radiation. Radiation classified into ionizing and non-ionizing. Non ionizing radiation does not have enough energy to produce ions, sun light, radio waves are some examples. Ionizing radiations radiation that has sufficient energy to dislodge outer electron from interacting matter that causes chemical changes in cells and damage them, some cells may die or become abnormal. Some of the early and late effects due to Radiation exposure are skin rash, diarrhea, long term genetic effects like Cancer. The most common type of ionizing radiation used in medicine all over the world is X-rays. Radiographers are one member of the medical team that deals with ionizing radiation X-ray. Work load among radiographer seem to put them at ionizing radiation

hazards for gastrointestinal system, reproductive system, in addition to different types of cancer, dermatological signs and symptoms, cataracts and genetic effects. Radiation protection is the science and art of protecting people and the environment from the harmful effects of ionizing radiation [9], It is also described as all activities directed towards minimizing radiation exposure patients and personnel nearby during x-ray exposure[5]. The objective of radiation protection is to define how one can protect individuals, their descendants and the human race against the potential risks of ionizing radiation [4] Exposure of tissues or organs to ionizing radiation can induce the death of cells on a scale that can be extensive enough to impair the function of the exposed tissue or organ which are called deterministic effects. This effect clinically observable in an individual only if the radiation dose exceeds a certain threshold. Above this threshold dose, a deterministic effect is more severe for a higher dose. Exposure to radiation can also induce the non-lethal transformation of cells which lead to cancer and hereditary effects such effects are called 'stochastic' effects. Stochastic effect is proportional to the dose received, with no threshold Radiographers are expected to have more in-depth knowledge on different aspects of radiation and should play a consultant role to the physicians in choosing a proper imaging modality with minimal radiation risk. Besides, one should consider the importance of good practice as well as adequate knowledge and attitude to reduce public dose due to imaging modalities. These items depend on several factors such as educational level and current policies for training personnel as well as the available accessories needed for good practice with an acceptable dose to the patient [12]. The study conducted in our country on final year medical student by Delliel and co-worker found final year medical students had poor knowledge on radiation protection which can proof that reduced awareness to radiation exposure protection is a global alarming problem that can have terrible consequences the upcoming years [5]. In a retrospective study conducted to evaluate the availability and utilization of gonad shielding during x-ray examination of the pelvis. The gonad shielding during x-ray procedures is an effective way of reducing radiation exposure to reproductive organs. Pelvic radiographs of both males and females were examined in four hospitals [11]. The findings were that radiographs with gonad protection were malposition with bony structures obscured or gonads insufficiently protected. Some hospitals surveyed had inadequate supplies of gonad shields in the general radiography rooms. The investigation concluded that patients in the hospitals under study received avoidable radiation to the gonads due to malpositioning or omissions during pelvic examinations [5]. Awareness and knowledge on application protection guidelines and instruments among radiology technicians has an important role to safe working. Radiation Protection is described as activities directed towards minimizing radiation exposure of both patient and personnel during x-ray exposure. These RP devices include lead aprons, lead glasses, lead gloves, gonad shields, thyroid shields, patient immobilization devices, and radiation area signs.

Health -care professionals have a responsibility to explain procedures and possible ill-effects to patients and benefits thereof. Consent should be sought from the patients before they undergo any radiological procedure. However, healthcare professionals also felt it is upon the patients to be curious about X -ray procedures done on them and learn to keep their X-rays when referred further to avoid more exposure to radiation Across sectional study done on Saudi Arabia by Mohammed Ahmed and co-workers in 2016 presented that only 41.7% of radiographers have Good knowledge toward radiation protection while 28% were not wear lead apron during work,, and they justified their performance by various reasons such as non-availability of enough numbers of lead apron in their departments or increased weight of apron and some of them preferred to follow position-distance rule rather than wearing lead apron, Using of light beam diaphragm and other protective devices (cone & grid) have percentage of 78.7%, whereas 61.3% were use wall shield during exposures, radiation signs are available during working hours for 57.3% of respondent [12]. The study done by UcheEze and co-workers on assessment of knowledge and practices of radiation protection by radiographers in Lagos, Nigeria shows that Average score on assessment of knowledge was 73%. Adherence to radiation protection practices was poor and most modern radiation protection instruments were lacking in all the centers studied. Application of shielding devices such as gonad shield for protection was neglected mostly in government hospitals. Most x-ray machines were quite old and evidence of quality assurance tests performed on such machines were lacking [15]. Research done on Italy stated that radiographer's knowledge is poor towards radiation protection Almost half of respondents were not able to differentiate a stochastic effect from a deterministic effect and about 40 % of respondents assessed that radiation damage occurrence is not dependent on patient gender and age. This inaccurate knowledge raises some doubts on radiographers' skills, which are fundamental to optimize daily radiological examinations. And also Young radiographers with less than 3 years of experience showed a higher level of knowledge compared with the more experienced radiographers. This may be due to the fresh study course of younger radiographers [3].

Briggs-Kamara and co-workers conducted survey indicated that more than 60 % of the radiographers did not give any explanation to patients before the procedure. This lack of instruction may generate fear in patients and prevent a good cooperation during the examination, along with a higher risk of needing to repeat it[8]. However, the study conducted by Mc. Okeji and co-workers in South West, Nigeria shows high rate of awareness and compliance of radiographers in to radiation safety standards as stipulated by national and international bodies. The radiation protection devices presented in most centers were impressive indicative of employers' willingness to abide by radiation standards [7]. The study carried out by khadoura and co-workers on 2016, in nine Gaza governorates hospitals 182 radio-diagnostic workers participated in the work. Based on the obtained data, the participants reported that 35.2% of personal radiation protection devices are available in the radio-diagnostic centers. In spite the fact that 74.8% of participants have awareness about radiation protection issues, but it is only about 53.4% of participants follows the radiation protection practices. The results represented in this work reflect that majority of participants believe there is no radiation safety officer to provide the service. Therefore, there is a desperate need for rules, regulations and radiation protection act in the

field of radiation in medical field [17]. The cross sectional study conceded by Bhat CR and co –workers in the Nepalese health facilities on occupational radiation exposure monitoring showed that only Six Health Care facilities had personal dosimeter service and available for a total of 149 radiation worker personnel. Of a total of nearly one million X-ray procedures performed in the 35 Health Care facilities in 2007, 76 % was performed by non-monitored personnel [6]. Another study in Saudi Arabia, examined the awareness of radiographers to radiation protection in three hospitals. This study included 75 radiographers where most of them were diploma holder (54.7%). Radiographers' ages ranged between 20 and 60 years old. This study revealed that 98.7% of the responders knew about radiation protection that walls and doors are made of lead and that wearing their dosimeters can tell the amount of radiation they are exposed to and this study recommended continuous training and workshops to improve their knowledge on radiation protection measures [11]. Similarly, a study that was done in Jeddah, Saudi Arabia to evaluate the awareness of final year medical students on radiation hazards and protection measures showed that the knowledge of final year medical students is inadequate and that they had many misconceptions about radiation doses and exposure to radiation as medical professionals. The study indicates further lectures and training is crucial for the future doctors [13]. Whereas radio-diagnostic centers have potential to present hazardous effects due of ionizing radiation. Radio-diagnostic worker's awareness, practices regarding radiation protection issues, availability of radiation protection devices and effective personal radiation exposure monitoring process has an important role to safe working places. The study done in Agra city of Saudi Arabia with objective of evaluating status of knowledge and practices towards radiation protection among radiographers, In this cross-sectional study, 50 participants was included in the study 68% subjects had experience of up to 5 years for working in radiology. All the respondents agreed to being exposed to radiation with 40% of them using radiation in 6-10 cases in a week. All the study subjects were aware of use of special materials in doors and walls such as lead for more protection, periodical radiation dose check from TLD and usage of personal Protective devices. Lead gloves or protective eyeglasses were never used by 70% and 76% of subjects respectively. The dosimeters were never/rarely used by 66% of the subjects. The dosimeters were rarely used by 66% of the subjects. The result revealed that there is knowledge -practice gap about usage of personal Protective devices among radiographers[11].

Methodology of Study

Study area

East Hareregе Zone, Hareri Region and Dire Dawa city located in Eastern part of Ethiopia about 500 km far from capital Addis Ababa. Ten Government Hospitals and eight Private Hospitals located in this area, all equipped with conventional X-ray machine.

Study Design

A facility based cross-sectional study was conducted to assess knowledge and practice of radiographers and medical radiology technicians toward radiation protection a case of East Hareregе zone, Hareri Region and Dire Dawa City Hospitals.

Sampling Method

Convenient sampling method was used to collect data from the study site as previously done by Mervet and co-workers [9], 75 participants were interviewed were on job while during data collection period.

Tool of Data Collection

Data collection occurred between December 14 and February 10, 2018, after receiving approval letter of the proposal. A structured questionnaire was designed for data collection by researcher, which was considering the scientific evidences regarding radiation protection and the existing literature on radiation protection, the questionnaire was used after testing the validity of its content through consultation by using 4 radiographers. The questionnaires include demographic data of the study subject as age, gender, Type of hospitals, level of education, Duration of Employment (years). Knowledge was assessed based on study participants understanding of ionizing radiation, occupation doses limit, human health risks associated with use of ionizing radiation, ways of radiation safety measures to protect themselves and patients. Radiation protection practice was assessed based on presence and use of radiation safety signs, radiation safety manuals, PPE, personal dosimeters and Response of radiographers to radiation safety compliance. Data was collected by informing the purpose of the research to the research subject, then through a face-to-face interview by using interviewer/researcher administered structured questionnaire.

Data Analysis

All the questionnaires were manually checked and edited for completeness and consistency, then coded for computer entry. After compilation of collected data, analysis was done by using statistical package for social sciences (SPSS) software windows version 21. One way ANOVA statistical test was used to analyze data based on the selected factors. Multivariate analysis using binary logistic regression and multiple linear regression models were computed to study the nature and strength of the relationship between dependent and independent variables. A 95% confidence interval and 5% absolute precision was used to determine the significance difference among spices. P-value < 0.05 will be considered as statistically significant in all cases.

Operational Definition

A) Operational definition to determine knowledge of radiographer to ward radiation protection.

Interpretation

1. If radiographers know >60 % out of the knowledge related questions: considered as Good knowledge towards radiation protection
2. If radiographers know < 60 % out of the knowledge related questions: considered as Poor knowledge towards radiation protection.

B) Operational definition to measure the level of practice
Interpretative

1. If radiographer's practices >60% out of practice related questions: considered as good practice toward proper radiation protection practice.
2. If radiographer's practices< 60 %out of practice

related question: considered as poor practice towards proper radiation protection practice [9].

Result

A total of 75 radiographers were studied among 78 radiographers and the response rate was 96.1 %. Among the participants, 69.3% were male and 30.7% were female with an average age of 27 and 25years, respectively. About 61.3% % of the radiographers had a diploma degree and, about 38.7% had a bachelor degree. 58.7% of them serve in government hospitals. Work experience of 68% of respondents were less than10 years.

Table1. *Socio-Demographic Characteristics of Radiographers in East Harerege zone, Hareri Region and Dire Dawa City Hospitals, June, 2019.*

Variable	Number and Percentage
Age 18-24yrs 25-30yrs 31-40yrs >41yrs	 21(28%) 23(30.7%) 15(20%) 16(21%)
Sex Male Female	 52(69.3%) 23(30.7%)
Qualification Diploma Bachelor Degree	 46(61.3%) 29(38.7%)
Type of Hospital Private Government	 31(41.3%) 44(58.7%)

Majority of respondents have good knowledge level regarding radiation protection. However, only 38.6% of radiographer scores good practical level

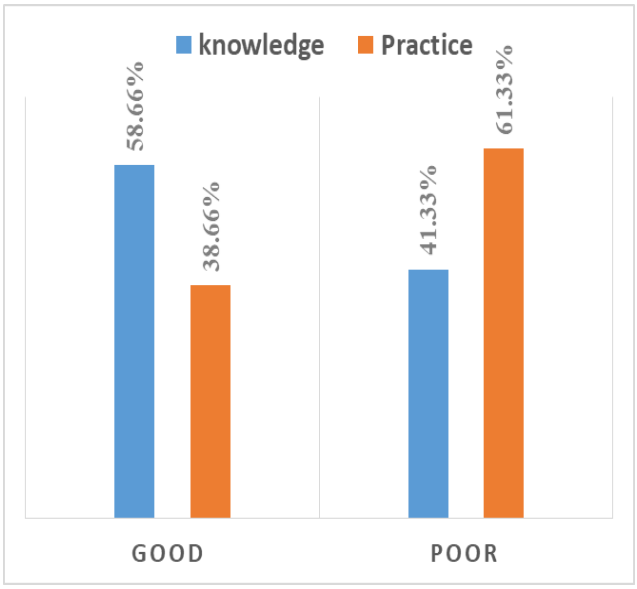

Figure 1: *knowledge and practice score of Radiographers in East Harerege zone, Harari Region and Dire Dawa City Hospitals, June, 2019.*

Among studied radiographers' majority of them know the health effect of ionization radiation which are 97.3%, those know three principles of radiation protection and sources of unnecessary irradiation in x ray room were 71%, 60% respectively. However, only 39 % of them knows occupational annual dose limit. From total of studied radiographer 62.7% of them admitted the presence of personal protective equipment's (lead apron, gonadal shielding and etc.) in their facility. On the other hand, only 30.7% and 34.7 % of them use lead apron and gonadal shielding during patient examination, respectively. In this study 49.3% give explanations about radiation safety for patient prior to examination.

Table 2: *Performance of participants toward Radiation Protection during practices in East Harerege zone, Harari Region and Dire Dawa City Hospitals, June, 2019.*

S/N	Characteristics	Yes	No
1	Radiation warning signs	63(84%)	12(16%)
2	Using lead glove	2(2.66%)	72(72.33%)
3	Using lead apron	23(30.66%)	52(69.33%)
4	Using thyroid collars	8(10.6%)	67(89.4%)
5	Using Gonad Shield	26(34.66%)	49(65.33%)
6	Wearing TLD daily during work	12(16%)	63(84%)
7	Using Eye goggle	11(14.6%)	64(83.48%)

According to this study 76% of them ask patients current history of pregnancy before examination however. Only 16% of radiographers have personal dosimeter and 13.3% are wearing regularly. Studies suggested that training and refreshment courses have beneficial effect on awareness and practice of radiographers. However, only 9.3% are get refreshment courses toward radiation protection. Majority of respondents which are 93.3% close the door before examination. Radiographers admitted radiation survey for environment and equipment done regularly in their hospital are only 8%. This study further revealed that the participants those do keeping patients' x-ray records regularly were only 6.6% and 5.3% of them ask previous history of x ray exposure.

Table 3*. Knowledge of Radiation Protection According to Occupational Characteristics in East Harerege zone, Hareri Region and Dire Dawa City Hospitals, June, 2019.*

Characteristic		N	Mean	SD	R	P
Gender	Male	52	63.28%	19.20%	-.058	.620
	Female	23	60.58%	26.48%		
Age	18-24 years	21	74.45%	17.35%	-.525	0.001**
	25-30 years	23	68.38%	15.43%		
	31-40 years	15	55.70%	18.51%		
	≥41years	16	44.51%	17.77%		
Educational level	Diploma	48	54.3%	20.12%	.506	.001**
	Degree	27	76.8%	15.84%		
Experience	0-4years	23	71.45%	16.96%	-.484	.0002**
	5-10years	28	67.84%	22.19%		
	11-14years	17	51.49%	16.84%		
	>15years	7	37.98%	14.56%		
Types of hospital	Government	44	59.30%	23.52%	-.175	.132
	Private	31	66.92%	17.79%		

** p<.05, ** p<.001*

According to the analysis, there was not any significant relationship between the sex of participants and their radiation protection knowledge (p= .620), There was a significant direct relationship between Educational level and knowledge of radiographers (p=.001), As regards knowledge of radiographers increased with those have higher educational levels (Degree). However, there is inverse relationship between Age and experiences of radiographers with their knowledge toward radiation protection, the highest level of knowledge regarding the radiation protection was for the personnel who with educational level of degree (Mean Score=76.8%), while the lowest was for those with greater than>15years of experience's. (Mean Score=37.98%) and among radiographers relatively those work on private hospitals have better knowledge toward radiation protection with (mean score of 66.93%). According to the analysis, there was not any significant relationship between the sex of participants and their radiation protection practice (p= .515) There was a significant direct relationship between Educational level and practice of radiographers (p=.002) As regards their practice toward radiation protection of radiographers increased with higher educational levels.

***Table 4**. Practice of Radiation Protection according to General Characteristics in East Harerege zone, Hareri Region and Dire Dawa City Hospitals, June, 2019.*

Characteristic		N	Mean	SD	R	P
Sex	Male	52	57.78%	18.50%	.076	.515
	Female	23	60.85%	19.30%		
Age	18-24 years	21	69.88%	15.60%	-.461	.000**
	25-30 years	23	59.13%	17.32%		
	31-40 years	15	57.68%	17.77%		
	≥41years	16	44.46%	16.37%		
Educational level	Diploma	48	67.47%	18.46%	.354	.002*
	Degree	27	53.80%	15.88%		
Experience	0-4years	23	68.18%	17.22%	-.478	.000**
	5-10years	28	59.23%	17.88%		
	11-14years	17	55.62%	14.49%		
	>15years	7	33.11%	8.782%		
Types of hospitals	Government	44	56.33%	19.24%	-.175	.189
	private	31	62.11%	17.58%		

** p<.05, ** p<.001*

However, there is inverse significant relationship between Age and experiences of radiographers with their practice toward radiation protection, the highest level of practice regarding the radiation protection was for the personnel who with age group between 18-24 years and those work on private hospitals have better practice for radiation protection with (mean score of 62.11%). while the lowest was for those with greater than>15years of experience's (Mean Score=33. 11%).There was a significant direct relationship between Knowledge of radiographers and use of personal dosimeter (p=.026). The type of hospital (governmental and private) had no significant effect on the radiation protection knowledge of the radiology staff.

***Table 5.** Correlation between Knowledge and Practice of Radiation Protection in East Harerege zone, Hareri Region and Dire Dawa City Hospitals, June, 2019.*

Category	*Practice of radiation protection*
Knowledge of radiation protection	*P=.0003***

** p<.05, ** p<.001*

As shown in Table 5, knowledge of radiation protection showed a statistically significant positive correlation with practice of radiation protection (p<.01). Therefore, radiographer with higher knowledge of radiation protection showed higher performance of radiation protection practice.

Discussion

Diagnostic radiography is defined by World Health Organization (WHO) as the use of radiation to produce images of internal structures of the body for diagnosis of diseases(WHO Diagnostic Imaging, 2014). The use of medical imaging has significantly expanded in recent past. For example in one decade Computed Tomography increased approximately three times in United States. Pakistan Nuclear Regulatory Authority (PNRA) makes similar claim stating that Radiography forms the largest share (48.63%) of radiation exposure to public in Pakistan[15]. In spite of the advancing applications of ionizing radiation in medical practice, it is very important to stick to high standards of radiation protection measures for both patients and medical staff safety. In addition to ensure that the medical imaging personnel are on high level of training and knowledge to guarantee a proper application for these safety measures. This cross-sectional descriptive study included 75 radiographers with the aim of assessing the knowledge and Practice of radiographers toward radiation protection in a case of hospitals located in Eastern Harerege zone, Hareri region and Dire Dawa city. The results of the present the work showed, 56.6% of radiographers have good knowledge for radiation protection and majority of them had poor practice which is better than the study done on Saudi Arabia which showed that only 41.7% of radiographers have good knowledge toward radiation protection. However, it is poor when compared with the study done in Lagos, Nigeria assessment of knowledge was good for 73% of radiographers [8]. The result further showed that there is inverse relationship between Age and experiences of radiographers with their knowledge and practice toward radiation protection, the highest level of knowledge and practice regarding the radiation protection was for the personnel those with age group between 18-24 years. Radiographers with less than 15 years of experience showed a higher level of knowledge and practice compared with the more experienced radiographers. This may be due to the fresh study course of younger radiographers. This result is almost similar with study done in Nigeria where the knowledge and compliance depend on years in practice because out of 97% who had good knowledge on safety standards and 80% of good compliances had less than 10 years in practice (Mc. okeji et al., 2010). However, study done in Iran found that Older staff (practice age > 15) had better radiation safety practice than younger ones (practice age ≤ 15). With increasing age and employment period, radiation safety practice also gets significantly better. Although they were recently educated, they had insufficient knowledge of radiation effects and

formal continuous training is necessary for younger radiological technologists [11] Ionizing radiation has many benefits for diagnosing diseases and the most common imaging modalities used in diagnostics are radiography (X-rays). It has sufficient energy to cause chemical changes in cells and damage them, some cells may die or become abnormal. Its hazards are classified into two main types' stochastic effects and deterministic effects. Stochastic effects are associated with long-time of exposure with low level of ionizing radiation dose that cause different types of cancer such as leukemia and hereditary effects. Deterministic effects appear in cases of exposure to high levels of ionizing radiation dose that cause radiation sickness as nausea, vomiting, general weakness, hair loss or diminished organ function and reproductive effects such as sterility. In this study majority of them know the health effect of ionization radiation which are 97.3%, However, only 42.3% of them able to differentiate a stochastic effect from a deterministic effect almost, similar with research done on Italy were half of respondents not able to differentiate a stochastic effect from a deterministic effect similarly (Paolicchi et al,2015). Safety warning signs are an important restriction that controls access to x-ray areas in order to alert workers about the area conditions and requirements, practically by taking a look to the obtained percentages; 84 % of studied radiographers mentioned the availability of Safety warning signs in their working hospitals which better result when compared with study done on Sudan which are 64%(Ahmed et al, 2015).The study done in Cairo revealed that, all of selected settings didn't use radiation warning posters and audible warning signals(Rania H. Mohammed, +2017). Furthermore, a study done by Swanson& Jim, in 2012 showed that, all of radiological departments had warning posters and visible & audible signs. Unfortunately, the investigator observed that, all the studied settings just used only X-ray labels on rooms not standardized warning posters Doing radiation survey regular by regulatory body was one of basic component of radiation protection for personnel and environment in the hospitals however only 8 % of radiographers admitted the presence of this action on their working hospitals and majority of them are those work on private hospitals and this result is alarming. The personal protection requirements of workers in the radiated area is one of the basics preventive measures in all health care & radiation safety policies, but in our country radiographers still suffer from carelessness about these basics. This study highlighted that the lowest availability and usage of radiation safety equipment's. Only 30.7% of the participants in this study wearing lead apron during any imaging procedure. This may be due to the poor availability of both personal and environmental safety devices in their work place, or it may be due to their carelessness to wear PPE during any imaging procedure. However, this result is surprising and alarming. It should be strongly recommended them to improve their knowledge around importance of wearing PPE, and update them through growing their expertise and this result was almost similar with research done in Khartoum Sudan were only 38% of radiographer's wear PPE during any imaging procedure[6]. It is mandatory, according to International Commission on Radiation Protection (ICRP) radiation safety standards, for gonads shields to be used for the protection of the gonads when the pelvis is not part of the anatomical area being examined [9]. In spite of good knowledge among radiographers in this study, only 34.7 % using gonad shields during examination. Critical issue during the use of radiation ispatient safety. It is the patient who is exposed to the maximum amount of radiation, both for the diagnosticand therapeutic purpose. It is imperative that steps aretaken to reduce the exposure of the patients. A key part of managing radiation safety is through education. Every person involved in radiation usage needs to know what radiation is and how to handle it because the number of diagnostic radiology procedures performed continues to grow yearly. In this study 49.3% give explanations about radiation safety for patient prior to examination. This lack of instruction may generate fear in patients and prevent a good cooperation during the examination, along with a higher risk of needing to repeat it [7]. This result disagree with study done by R.Modiba in South Africa were75% of radiographers held a view that the community was not informed at all about radiation exposure risks. They gave reasons ranging from illiteracy in the community to lack of awareness programmers by health - care professionals. Ignorance also contributed to this finding, as there had always been information displayed in X-ray rooms, indicating caution and how pregnant patients should be managed. International organizations have published recommendations on the quantities and units that should be used in occupational dosimeter and indicates annual occupational dose limit. Dose limits to workers are expressed in terms of equivalent dose in an organ or tissue for exposure of part of the body and effective dose for whole body exposure. The committee (ICRP) that determines dose limit, explain that dose limit may be change in future. The possible changes will relate to new adverse effects of radiation in human that had not been detected yet. Therefore, in different time duration, personnel should be aware of dose limit and protect themselves in determined limit. The radiological technician those participated in this study, responded correctly to this question about the amount of occupational annual dose limit were only 39 %, it is deprived when compared with study conducted in Iran were 72 % of them know occupational annual dose limit [9]. It has been recommended by ICRP that the annual occupational exposure to radiation should be limited to 20mSv over a period of five years. Therefore, the use of dosimeters is indispensable to measure the amount of radiation received by the workers. However, this study exposes distressing results as a big chunk of study subjects only 16% used dosimeters. It makes difficult to estimate radiographers and public radiation burden they suffer from medical sources and this may have very serious consequences, as one would never be conscious of the amount of radiation received. This may have very serious consequences, as one would never be conscious of the amount of radiation received. Another critical issue during the use of radiation is patient safety. It is the patient who is exposed to the maximum amount of radiation, both for the diagnostic and therapeutic purpose. It is imperative that steps are taken to reduce the exposure of the patients and this result disagree with study done in Saudi Arabia were only 44% where use personal dosimeter Regarding periodical radiation dose check from TLD, authors from Nigeria reported that 98.7%of the staff had periodical radiation dose check from their TLDs (wearing TLDs during their work hours). They also reported a better attitude to wearing radiation dosimeters among a sample of industrial radiographers of Nigeria [8]. On job training mandatory for radiographers to increase awareness and practices of radiation protection. and coworkers observed

practices of pregnancy test prior to nuclear diagnostic procedures. Compliance with radiation safety protocols includes the filing or keeping of X-ray records and Requirements for radiography stipulate that a record/register of all patients undergoing X ray examinations must be stored for a period of at least 5 years [11]. However, in this study the participants those do keeping patients' x-ray records regularly were only 6.6% and 5.3% of them ask previous history of X ray exposure. This could lead to patients being subjected to further unnecessarily radiation exposure. This is in line with the ALARA principle which expects health-care professionals to minimize radiation exposure to patients. This result agree with study done with South Africa were 19% of radiographers never keep the patients' records [14].

Conclusion

The present study conducted to assess knowledge and practice of radiographers and medical technologist toward radiation protection a case of East Harerege zone, Hareri Region and Dire Dawa City Hospitals, study showed good knowledge of radiation hazards and protection of radiographers and medical technologist. However, adherences to radiation protection practices among these radiographers were poor. This study illustrated that Educational level had significant direct effect on knowledge and practice of radiographers toward radiation protection However, there was inverse significant relationship between Age and experiences of radiographers with their knowledge and practice of radiation protection, knowledge of radiation protection showed a statistically significant positive correlation with their practice of radiation protection. This study revealed that inadequate radiation protection devices in hospitals. There were also only small hospitals that availed personal dosimeter for their radiographers and the occupational exposure status of majority of the radiographers were unknown. Doing radiation survey was one of basic component of radiation protection for personnel and environment in the hospitals. However, only few hospitals in this study done radiation survey at regular base. Majority of the radiographers didn't get Radiation protection and safety training after they started work. So radiographers should embrace current trends in radiation protection and make more concerted efforts to apply their knowledge in protecting themselves and patients from harmful effects of ionizing radiation.

Recommendation

Hospitals have availed personal protective devices and Disseminating the culture of using PPE and all safety gadgets plus highlighting the importance of them. Hospitals should have established radiation safety committee that monitors safe radiation practice in hospital. Hospitals should be assign radiation safety officers and regularly monitored by regulatory body to ensure safe work place for patients and radiographers. Continuing training and professional developed programs chances should be provided to staff members in order to keep skills and knowledge up to date to achieve high standard safe work place for them self and clients. Ethiopian Radiation Authority should have to be establishes Regulatory office's at Regional and Zonal level and monitor radiographers' performance and safety more effectively.

Limitation of the study

The significant limitation of the study was being unable to observe the subjects during various radiological procedures, starting with the interaction with the patients, where consent is sought and radiation risks explained. It is acknowledged that the questionnaire might not have been sufficient to address the key questions in depth because of the inability to probe further, but the open -ended portion complemented this shortfall. Consideration was also taken to the fact that the study will be done during official working hours, and therefore would not want to cause disruptions or take participants off work for a long time.

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