



**ADDIS ABABA UNIVERSITY**  
**COLLEGE OF MEDICINE AND HEALTH SCIENCES**  
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**DEPARTMENT OF RADIOLOGY**

**RESEARCH TITLE**

*ASSESSMENT OF NURSES' KNOWLEDGE AND ATTITUDE TOWARDS IONIZING RADIATION DURING RADIODIAGNOSTIC IMAGING AND PROCEDURES AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA UNIVERSITY, ADDIS ABABA, ETHIOPIA.*

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A RESEARCH REPORT TO BE SUBMITTED TO RADIOLOGY DEPARTMENT, COLLEGE OF HEALTH SCIENCE, ADDIS ABABA UNIVERSITY AS PART OF PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE STUDY IN DIAGNOSTIC RADIOLOGY.

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## ABSTRACT

Basic knowledge and attitude towards ionizing radiation and radiation practice during radio-diagnostic imaging and procedure was assessed on nurses working at Tikur Anbessa Specialized Hospital was assessed. The major objective of the study was to assess the knowledge and attitude gap of nurses when dealing with radiation and radiation protection practice during radio-diagnostic examination and procedures. A questionnaire-based, cross-sectional study was conducted in Tikur Anbessa Specialized Teaching Hospital from March 2017G.C to August 2017G.C. A convenient sampling method was used where all nurses' working in departments and unites where radio-diagnostic imaging and procedures are undertaken namely the departments of Radiology, Oncology-Radiotherapy, ICU, NICU, Orthopedic-OR, and Cardiac Catheterization unit were participated. A self-administered questionnaire forms were distributed to 116 nurses to fill up the questioner forms within two weeks period out of which 111 nurses responded to the questionnaire. The study has shown that participants within the age group of 26 -30 years had the highest compared to those within the age group of 41 to 45years who scored the least frequency. Most of the nurses 97 (87.4%) had BSc as their highest qualification followed by 10(9%) MSc holders. The majority of participants' have insufficient knowledge suggested by the mean knowledge percent score of 47.9 % and only 24.3% of the participants correctly answered more than 50% of the questions. Moreover Only 32% of nurses practice radiation protection by keeping distance from sources of exposure and shielding. The Majority of nurses 41% keep distance from source of radiation during exposure as a radiation protection method. Finally, Findings of this study revealed that nurses' with in Tikur Anbessa Specialized Hospital working in radiation related areas had insufficient knowledge and low awareness of ionizing radiation, and their attitude towards radiation protection during radio-diagnostic examination is poor and have unsafe practice.

Key words: *Radiology, Tikur Anbessa Specialized Hospital, radio-diagnostic*

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## **ABBREVIATIONS AND ACRONYMS**

CHS: College of Health Science

US: Ultrasound

CT: Computed Tomography

MRI: Magnetic Resonance Imaging

TASH: Tikur Anbessa Specialized Hospital

ICU: Intensive Care Unit

NICU: Neonatal Intensive Care Unit

ALARA: As low as reasonably acceptable

BLH: Black Lion Hospital

JU: Jimma University

ICRP: International Commission on Radiological Protection

MD: Medical Doctor

## 1. INTRODUCTION

### 1.1 BACKGROUND

Diagnostic imaging and interventional radiological techniques are nowadays increasingly used to diagnose a wide range of diseases and to do both diagnostic & therapeutic interventional procedures[1]. Currently diagnostic imaging is becoming the right hand of most physicians and most of medical decisions are made based on imaging. However, the use of radiation is limited by its relevant hazards to patients and health care providers [2].

Ionizing radiation comes from both natural and man-made materials [3]. Man-made radiations accounts for 18% and from this 15% exposures are due to the medical x-rays and nuclear medicine imaging [4]. We can do little for radiations that comes from natural sources but the ionizing radiation that comes from man-made sources can be controlled and prevented[3] [4]. In general there are two categories of imaging modalities: ionizing radiation (such as X-ray, fluoroscopy, mammography, and nuclear medicine and CT) and non-ionizing radiation (such as ultrasound, magnetic resonance imaging)[5].

The International Commission on Radiological Protection (ICRP) is the primary body in protection against ionizing radiation. ICRP is a non-governmental organization created by the 1928 International Congress of Radiology and clearly defined the overall objective of radiation protection and stated its purpose as providing an appropriate standard of protection for man without unduly limiting the beneficial practices giving rise to radiation exposure [6]. The triad of radiation protection includes reduction of exposure time, increasing distance from source, and shielding of patients and occupational workers have proven to be of great importance in protecting patients, personnel, and members of the public from the potential risks of radiation [7].

Nurses may support patient and assist during radiologic examination and procedure and they prepare the instruments needed during interventional procedures. Nurses working in the radiology departments or wards where ionizing radiation takes place need to be knowledgeable about radiation and radiation protection practices. However, despite their role in radio-diagnostic imaging procedure they are academically uninformed and professionally unaware of radiation

protection methods [8]. Nurses' good knowledge on radiation protection is helpful to protect themselves as well as the patients and the public from unnecessary radiation exposure and this will reduce unnecessary radiation exposure and its impacts.

## **1.2 STATEMENT OF THE PROBLEM**

Misconceptions about radiation are common among nurses, resulting in undue fears and concerns that may negatively affect patient care. The researchers observed that during radiographic examinations on the ward, some nurses are extremely afraid to stay within the vicinity during radiation exposures [9]. These reactions of some nurses towards ionizing radiation and the need to understand why they behave differently prompted the researchers' interest to find out the level of knowledge on ionizing radiation and their attitude towards radiation protection. The observation is also similar in our set up.

In Ethiopia there are three researches done on knowledge and awareness about radiation exposure one among medical doctors in BLH, among medical interns and final year medical students and the third is done among patients in Jimma University. To my knowledge in our country there is no study done regarding awareness and attitude of nurses about radiation and radiation protecting mechanisms.

## **1.3. SIGNIFICANCE OF THE STUDY**

This study aims to assess the nurses' knowledge and attitude towards radiation and practice of radiation safety among the nursing staffs working at Black Lion Specialized Hospital and to recommend if further radiation safety training is required.

## **2. LITERATURE REVIEW**

There are about four studies done on the assessment of nurses' knowledge and attitude towards radiation, and three of them is from African countries and one was done in Australia. The study done in Australia major tertiary hospital which participated 147 nurses found out that nurses had poor knowledge about radiation with the percentage of correct answer was 42%[10]. Another study done among 43 nurses working in Korle-Bu Teaching Hospital of Ghana found out that majority of nurses had limited knowledge about ionizing radiation[11]. A similar finding was suggested in a research done in 2014 among 44 intensive care nurses working at intensive care units of Shahid Beheshti Hospital of Kashan, Iran [12]. In a study conducted in Nigeria in 2016 participating 188 nurses suggested that 60.4% of the nurses had good knowledge of ionizing radiation [13].

Regarding the attitude and practices of radiation practices, the study done in Iran revealed that the participating nurses had poor attitude and leaving the ICU was the most common radiological protection strategy they used. Only three nurses out of the 44 participating nurses had stayed at the nursing station and continued monitoring patients during radiological examinations. While the rest of the nurses had left the room where radiological examinations was being done [12]. The study done in Australia found out that the awareness of radiation safety was poor throughout the hospital nursing staff and from the nurses surveyed 59% indicated that they had not received any formal radiation safety training [10].

The nurses' perception on ionizing radiation protection during mobile radiographic examination in Ghana concluded that misconceptions about radiation exposure risks that could potentially affect health care decisions were present among nurses. They indicated that the absence of curricula in basic radiation protection in the nurses training program had resulted in poor knowledge on the subject [11].

The study done in Nigeria revealed that the respondents had positive (good) attitude towards ionizing radiation during theatre and ward radiography, whereas 132 (70%) of them practice good radiation protection by shielding (use of lead apron) and keeping distance from patients

during radiographic exposures and this was influenced by the level of education attained and years of professional practice. On cross-tabulating educational qualification and attitude, towards radiation protection, it was shown that participants with MSc. and above had good radiation protection practice. The study also found that positive attitude increase with increase in years of professional practice [13].

### **3. OBJECTIVES**

#### **3.1 GENERAL OBJECTIVE**

The general objective of the research is to assess the nurses' knowledge about ionizing radiation and their attitude and practice of radiation safety measures they use during radio-diagnostic imaging and procedure.

#### **3.2 SPECIFIC OBJECTIVES**

The specific objectives of the research were to:

- Determine the knowledge and attitude of nurses about radiation and radiation protection mechanisms.
- Determine the possible factors affecting their knowledge, attitude and practice of radiation protection mechanisms.

## **4. METHODS AND MATERIALS**

### **4.1 STUDY AREA AND PERIOD**

The study was conducted at TASH, College of health science, Addis Ababa University, Addis Ababa Ethiopia. TASH is located in the nation's capital, Addis Ababa, and is the largest referral as well as the main teaching hospital in the country. There are about 870 nurses working in the hospital. The study was conducted from March 2017 to August 2017 G.C.

### **4.2 STUDY DESIGN**

The research was designed as hospital based descriptive cross sectional study using self-completion questioner. The study was conducted from March 2017 to August, 2017G.C.

### **4.3 POPULATION**

#### **4.3.1 SOURCE POPULATION**

The source population was all nurses who are working in TASH in 2017G.C.

#### **4.3.2 STUDY POPULATION**

All nurses who are working in departments and units where there radio-diagnostic imaging and procedures are undertaken includes the department of Radiology, Oncology-Radiotherapy unit, Orthopedics-OR, Cardiac Catheterization laboratory, ICU& NICU.

#### **4.3.3 INCLUSION AND EXCLUSION CRITERIA**

##### ***4.3.3.1 INCLUSION CRITERIA***

All nurses who are working in the departments or units of Radiology, Oncology-Radiotherapy unit, Orthopedics-OR, Cardiac center-Cat Lab, ICU & NICU.

##### ***4.3.3.2 EXCLUSION CRITERIA***

Those who are on their leave and unwilling to participate and nurses working in other departments than the listed departments will be excluded.

### **4.4 SAMPLING TECHNIQUE AND SAMPLE SIZE**

The convenience sampling method was used where Subjects were selected based on their more radiation exposure than other nurses working in the department of Radiology, Oncology-Radiotherapy, ICU, NICU, Cardiac Catheterization laboratory, Orthopedics-OR. All nurses working in the stated departments were participated.

#### **4.5 DATA COLLECTION**

The data was collected using self-administered structured questionnaires. All nurses working in the departments of Radiology, Radiotherapy, ICU, NICU, Cardiac Catheterization Laboratory and Orthopedic-OR were included. All data regarding demographic, their knowledge and attitude towards radiation was retrieved from the questionnaire.

#### **4.6 STATISTICAL ANALYSIS AND INTERPRETATION**

Statistical analysis was performed using the statistical package for the Social Sciences for windows (SPSS 20.0) and descriptive statistics including frequency distribution, mean, standard deviation and percentages .Level of knowledge was calculated as a percentage of correct answers in each section. Mean knowledge score more than 50% were considered good knowledge. Regarding the assessment of attitude and practice of radiation, safety practice those who answered two of the three principle of radiation protection method was taken as a safe radiation practice.

#### **4.7 ETHICAL CONSIDERATIONS**

In order to respect nurse's bill of right ethical considerations was taken in to account. Clear and detail explanations was given to the Metrone, nurses' head in each department, and the participants in the study were told about the objective of the study. Any piece of information was kept confidential by not recording names of nurse. The study was conducted after approved by the departmental, Research and Ethics Committee.

## 5. RESULTS

One hundred and eleven questionnaires were filled by participants (response rate; 95.7%). The participants included 46 ICU, 18 NICU, 14 Orthopedic-OR, 13 Cardiac Catheterization laboratory, 12 Radiotherapy unit & 8 Radiology nurses. The study found that female respondents were 68 (61.3%) while male were 43 (38.7%) with male to female ratio of 1.6:1. The respondents' age group ranged from 21 to 25 years and 46 years and above. Respondents with the age group of 26 -30 years had the highest while those within the age group of 41 to 45 years had the least frequency. Most of the nurses 97 (87.4%) had BSc as their highest level of qualification followed by MSc holders who were 10 (9%). Only two nurses (1.8%) have Diploma and two (1.8%) are certificate holders. In terms of years of experience, 61 (55%) had practiced for 0-5 years, 32(28.8%) had practiced for 6-10 years, 13(11.7%) had practiced for 11-15 years. Moreover, 5 (4.5%) had practiced for more than 21 years. The majority nurses 81.1% didn't receive any radiation safety training; however, only 9% of nurses had a formal training on radiation safety. In addition, 9.9 % of nurses read about radiation safety (Table 1).

Table-1: frequency distribution of socio-demographic characteristics of respondents

Demographic data		Number (%)
Sex	Male	43(38.7%
	Female	68 (61.3 %)
Age group in years	21-25	34 (30.6 %)
	26-30	43 (38.7 %)
	31-35	22 (19.8 %)
	36-40	5 (4.5 %)
	41-45	3 (2.7 %)
	46 and above	4 (3.6 %)
Level of education	Certificate	2 (1.8 %)
	Diploma	2 (1.8 %)
	Msc	10 (9 %)
	BSc	97 (87.4 %)
	PhD	0
Years of professional practice	0-5	61 (55.0 %)
	6-10	32 (28.8 %)
	11-15	13 (11.7 %)
	16-20	0
	21 and above	5 (4.5 %)
	Total	111 (100 %)
Received of any specific education on radiation in medical imaging	Yes	21(18.9%)
	No	90(81.1%)
If yes (n=21)	Formal education	10(47.6%)

	Informal education	11(52.4%)
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The majority of nurses 108 (97.3%) agreed radiation used in medical imaging can possibly cause harmful effects while two (1.8%) disagreed to it, and one (0.9%) nurse answered do not know. Majority of nurses 60 (54.1%) disagreed to radiation used in medical imaging has more harm than benefit, the remaining 42 (37.8%) agreed and 9 (8.1%) nurses admitted that they do not know. Majority of nurses, 55(49.5%) wrongly assumed that objects in the room emit radiation after an X-ray exposure, only 24 (21.6%) answered no while 32(28.8%) do not know. Most of the nurses 57(51.4%) answered gonads as the most sensitive organ for radiation while others do not. 52(46.8%) nurses answered correctly to the question which imaging modality has no radiation but the rest answered incorrectly. Only 37(33.3%) nurses answered correctly to the imaging modality, which has more radiation exposure. Majority of nurses 70(64.2%) agreed that children are more radiosensitive than adult. 10(9.2%) answered adult and children have same radio sensitivity. However, 24(22.2%) answered children are less radiosensitive than adult. 24(22.2%) admitted that they do not know. 61(55.0%) nurses answered correctly to generally we receive radiation in our everyday life. In contrary, 36(32.4%) disagreed and 14(12.6%) do not know.60 (54.1%) nurses wrongly answered that radiation which is used in wards and theatres are more dangerous than those in the radiology department.48 (43.2%) nurses wrongly assumed the lifespan of radiology workers are reduced when compared with other health workers while 27(24.3%) nurses disagreed and 36(32.4%) do not know as shown Table-2.

Regarding nurses' knowledge, the mean knowledge percent score was  $47.9 \pm 21.4$ . The number of nurses who answered correctly more than five out of ten questions were 27 (24.3%) nurses. The majority of nurses 84(75.7%) were classified as having poor knowledge, while only 27 (24.3%) was classified as having good knowledge.

Table-2 Nurses' knowledge on radiation(1).

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Items	Yes	No	I do not know
Generally we receive radiation in our everyday life	61(55.0%)	36(32.4%)	14(12.6%)
Radiation can cause harmful effects	108(97.3%)	2(1.8%)	1(0.9%)
Radiation used in medical imaging cause more harm than benefit	42(37.8%)	60(54.1%)	9(8.1%)
Objects in the room emit radiation after an X-ray exposure	55(49.5%)	24(21.6%)	32(28.8%)
Radiation that is used in wards and theatres are more dangerous than those in the radiology department	60(54.1%)	34(30.6%)	17(15.3%)
The lifespan of radiology workers are reduced when compared with other health workers	48(43.2%)	27(24.3%)	36(32.4%)

Table-3: Nurses' knowledge on radiation(2).

	Gonads	Breast	Brain	Heart
<b>Most sensitive organ for radiation</b>	<b>57(51.4%)</b>	<b>17(15.3%)</b>	<b>29(26.1%)</b>	<b>8(7.2%)</b>
<b>No radiation</b>	MRI 52(46.8%)	x-ray 5(3.6%)	Mammography 38(34.2)	CT 16(14.4%)
<b>More radiation</b>	MRI 22(19.8%)	x-ray 50(45%)	US 2(1.8%)	CT 37(33.3%)
<b>Radio-sensitivity of a child compared with adult</b>	More 70(64.2%)	Same 10(9.2%)	Less 5(4.6%)	I do not know 24(22.2%)

The attitude and radiation safety practice of nurses used to protect themselves during radio-diagnostic exposure was assessed based on the three protection principles: distance, shielding, and time and choosing more than one option was given. 39 (35%) nurses practiced two of the three-radiation protection principles provided in the questioner. 30(27%) nurses practice radiation protection by Keeping distance from sources of exposure and use Lead Apron. The majority of nurses 46 (41%) keep distance from source of radiation during exposure.

Table-4: Techniques of radiation protection during radiographic exposure.

Identify techniques of radiation protection you are aware of (more than one answer was possible)	Number (%)
Keep distance from sources of exposure& Use lead apron during radiographic exposure	30(27%)
Keep distance from sources of exposure	46(41%)
Use lead apron during radiographic exposure	22(20%)
Coming to the vicinity after x-ray exposure	13(11.8%)

On cross tabulating nurses' knowledge about radiation and attitude towards radiation protection methods with years of professional practice. The study shown that there is no association between experience and radiation awareness except as the years of professional practice increases the knowledge regarding the imaging modality, which has more radiation exposure increased. However, there was no association on the other nine parameters we have used to assess the nurse's knowledge level and years of professional practice(Tables 5& 6).

Table-5: Cross-tabulating year of experience against Nurses knowledge on radiation

Variables		Years of professional experience				Chi-square	p-value
		0-5	6-10	11-15	>16		
Most radiation sensitive organ	Brain	18(29.5)	7(21.9)	3(23.1)	1(20.0)	5.61	0.77
	Heart	4(6.6)	4(12.5)	-	-		
	Gonads	29(47.5)	17(53.1)	7(53.8)	4(80.0)		
	Breast	10(16.4)	4(12.5)	3(23.1)	-		
More radiation exposure	US	-	1(3.1)	-	1(20.0)	19.5	<b>0.02</b>
	MRI	15(41.0)	3(9.4)	4(30.8)	-		
	X-ray	28(45.9)	14(43.8)	7(53.8)	1(20.0)		
	CT	18(29.5)	14(43.8)	2(15.4)	3(8.1)		
No radiation	MRI	25(41.0)	16(51.6)	8(61.5)	3(60.0)	13.3	<b>0.15</b>
	X-ray	4(6.6)	-	-	-		
	CT	6(9.8)	6(19.4)	4(30.8)	-		
	Mammography	26(42.6)	9(29.0)	1(7.7)	2(40.0)		
Radio-sensitivity of a child compared with adult	The same	6(9.8)	4(12.9)	-	-	10.37	0.32
	Less	5(8.2)	-	-	-		
	More	40(65.6)	17(54.8)	10(83.3)	3(60.0)		
	I do not know	10(16.4)	10(32.3)	2(16.7)	2(40.0)		

Table-6: Cross-tabulating years of professional experience against attitude toward radiation

Protection technique		Years of professional experience				Total	Chi-square	p-value
		0-5	6-10	11-15	>21			
Keep distance from sources of exposure	Yes	43(70.5%)	20(62.5%)	10(76.9%)	5(100%)	78(42.4%)	3.33	<b>0.35</b>
	No	18(29.5%)	12(37.5%)	3(23.1%)	-			
Use lead apron during radiation exposure	Yes	32(52.2%)	16(50%)	5(38.5%)	3(60.0%)	56(30.44%)	1.03	<b>0.79</b>
	No	29(47.5%)	16(50%)	8(61.5%)	2(40.0%)			
Coming to the vicinity after x-ray exposure	Yes	12(19.7%)	9(28.1%)	5(38.5%)	1(20.0%)	50(27.2%)	2.41	<b>0.49</b>
	No	49(80.3%)	23(71.9%)	8(80.0%)	4(80.0%)			

## 6. DISCUSSION

Our results showed that most of the nurses are young, the age group of 21- 30 years accounts 69.3% of the participants and 61 (55%) nurses had working experience of less than five years and below signifying that most of the respondents were young in professional practice. There was no significant difference on the level of education of the participant nurses, as the majority of the nurses 97 (87.4%) have BSc as their highest level of qualification followed by MSc holders who were 10 (9%). This is because Tikur Anbessa Specialized Hospital is one of the major specialized Hospital in our country where most of the employee are at least bachelor degree holders. These findings are not similar to that of the research done in Nigeria where most of the nurses had diploma as their highest qualification and it was attributed to more certificates and diploma awarding nursing institutions in Nigeria [13].

In our study majority of nurses 91% didn't receive any radiation safety training and only 9% of nurses had a formal training on radiation safety .This is in agreement with a study done in Australia, an ideal set up where training is given frequently indicated that 59% of nurses had not received any formal radiation safety training[10].

The participants had poor knowledge of ionizing radiation and only 24.3% knew the source, benefit and potential harm of ionizing radiation. The most correctly answered questions were about the harmful effect of radiation and the most sensitive organ for radiation as Gonads. This is probably due to the general knowledge in the society about radiation and the fear everyone has towards radiation and its well-known and accepted exaggerated perception effect by our society as it causes infertility and cancer. The mean knowledge score was found to be 47.9%, which is below 50%. This falls under the category of poor knowledge score with a wide confidence interval of 26.5% to 69.3%. This wide variability may indicate that they do not have a uniform or standard knowledge about radiation since there no formal education in the nursing curriculum and training. This finding is consistent with the research made in Ghana; they found that the majority of nurses have limited knowledge about ionizing radiation [11]. This finding is also in agreement with the study done in Iran, which revealed the participating nurses had limited knowledge of radiation protection [12]. However, this finding is not in agreement with the study done in Nigeria where the nurses had good knowledge of ionizing radiation and about 60.4% knew the source, benefit and the potential harm of ionizing radiation [13]. The poor knowledge among the participants in our Hospital is probably due to the absence of any specific radiation education in the nursing curricula and absence of training about radiation as the study found out that 90(81.1%) nurses do not received any form of formal or informal education about radiation.

The study found that only 30(27%) nurses Keep distance from sources of exposure and use shielding during radiographic exposure but the majority of nurses 46 (41%) keep distance from source of radiation and during radiation exposures, this is perhaps because of the undue fear of radiation, and they do not want to stay around where radiation exposure is undergone. This is in agreement with study done in Iran, which revealed that the participating nurses had limited knowledge of radiation protection and only three nurses out of the 44 participating nurses had good attitude towards radiation protection techniques [12]. This is not in agreement with the

research done in Nigeria, 70% of the participant practice good radiation protection by shielding (use of lead apron) and keeping distance from patients during radiographic exposure [13].

It was also shown that the participants' level of education and years of practice did not affected their knowledge and attitude towards radiation and this is probably due to the absence of radiation specific education in the nursing curriculum and lack of radiation protection training throughout their professional practice. This made all nurses despite their level of education and years of practice to have similar knowledge level and radiation safety practice. This is not in agreement with the research done in Nigeria; they found that participants with MSc. and above have good radiation protection practice and they also found that positive attitude increase with increase in years of professional practice [13].

## **7. CONCLUSION**

Findings from this study showed that the participants have poor knowledge and low attitude towards ionizing radiation during radio-diagnostic examinations and procedures. In addition, their level of profession education and professional years of practice did not influence. The majority of nurses 91% do not received any form of formal education or training about radiation and this is the major attributing factor for their poor knowledge and attitude about radiation and poor radiation protection practice.

## **8. RECOMMENDATION**

We recommend that training on radiation protection to educate all the nursing staff should be given on a regular basis and posters on radiation protection methods should be posted at least in everywhere where radio-diagnostic examinations and procedures are made. If possible, we strongly recommend basic education about radiation should be included in the nursing training curriculum.

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