ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE

KNOWLEDGE, ATTITUDE AND PRACTICE OF ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE MEDICAL STUDENTS AND ASSOCIATED FACTORS REGARDING RADIATION EXPOSURE TO COMMON DIAGNOSTIC IMAGING PROCEDURES

BY: - DR. HANAN ABDULRAHMAN (INTERN)

A STUDENT RESEARCH REPORT TO BE SUBMITED TO THE DEPARMENT OF PUBLIC HEALTH, ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE, IN PARTIAL FULFILLMENT OF THE REQUIREMENS FOR THE DEGREE OF DOCTOR OF MEDICINE

AUGUST, 2018
ADDIS ABABA,
ETHIOPIA

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St. Paul's Hospital Millennium Medical College

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Acknowledgment

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Abbreviations & Acronyms

CT- Computed Tomography

CXR - Chest X-ray

DNA- Deoxyribonucleic acid

GP - General Practitioner

MRI - Magnetic Resonance Imaging

Sv- Sievert

mSv- millisieverts

μSv- Microsieverts

PET Scan- Positron emission tomography Scan

SPHMMC- St. Paul's hospital millennium medical college

US- Ultrasound

WHO- World Health Organization

Abstract

Background: Ionizing radiation is widely used to diagnose and treat diseases worldwide. Improved knowledge and practices of medical doctors regarding hazards of ionizing radiation is one of the first steps in protecting patients and practitioners from radiation exposure. Various researches including those done in our country show lack of knowledge about ionizing radiation to common diagnostic imaging. Since medical students are the future physicians it is very important to improve their knowledge, attitude and practice regarding radiation exposure to common diagnostic imaging so they can in turn promote safe as well as appropriate use of radiologic resources.

Objective: This study aimed to assess the knowledge, attitude and practice of SPHMMC medical students and associated factors regarding radiation exposure to common diagnostic imaging procedures from March 12, 2018 G.C. to June 15, 2018 G.C.

Methodology: A hospital based cross-sectional analytic study was conducted on undergraduate clinical year medical students and interns of SPHMMC from March till June of 2018. self-administered structured questionnaire was developed for this research and employed to collect data. The study included 226 participants from clinical year medical students and interns. Simple descriptive statistics such as frequency and percentage is used to summarize the results. Chi-square, bi-variate and multi-variable regression was used to describe the association between level of education, Clinical attachment to radiology department, Confidence with knowledge, perceived importance and knowledge, attitude and practice.

Results: Only 1.8% of the participants had good knowledge while 83.2% and 84.1% had negative attitude and poor practice towards radiation safety respectively. Respondents who had negative attitude were also more likely to have poor practice of protective measures and fourth year students were found to be 10 times more likely to have good practices of protective measures against ionizing radiation as compared to interns

Conclusion: The study showed that Clinical year medical students and interns had lacking knowledge regarding ionizing radiation and that majority of participants had negative attitude and poor practice of protective measures from ionizing radiation. Further education of medical students is recommended to address the evident lack of knowledge regarding radiation exposure in order to minimize risk of exposure to physicians and patients as well as to promote safe practice and positive attitude towards radiation safety.

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1. Introduction

1. 1. Background

Radiation is the dispersion of energy from a source in the form of particles or electromagnetic waves. There are two forms of radiation, ionized and non-ionized. Ionizing radiation involves the detachment of electrons from subatomic particles or electromagnetic waves at the atomic or molecular level, thus forming ions [1-3].

Medical use of radiation accounts for 20% of the total population exposure and 98% of population exposure dose from all artificial sources. Annually, more than 3600 million diagnostic radiology examinations are performed, 37 million nuclear medicine procedures are carried out, and 7.5 million radiotherapy treatments are given worldwide [3].

The absorbed dose of radiation is expressed in a unit call the gray (Gy). The effective dose is used to measure ionizing radiation in terms of the potential for causing harm. The Sievert (Sv) is the unit of effective dose that takes into account the type of radiation and sensitivity of tissues and organs. It is a way to measure ionizing radiation in terms of the potential for causing harm. The Sv is a very large unit so it is more practical to use smaller units such as millisieverts (mSv) or microsieverts (μSv) [3].

Ionizing radiation causes structural damage at the cellular or molecular level. The proposed mechanism for cellular damage involves the production of free radicals. These free radicals interfere with chemical bonds between molecules that regulate key cellular processes. Direct interaction between ionizing radiation and cellular macro-molecules leads to DNA mutation or cell death, while indirect interaction causes free radical damage to essential cell enzymes [2-4].

Damage to tissue and/or organs from radiation depends on the dose of radiation received, type of radiation and sensitivity of different tissues and organs. Radiation can impair the function of tissues and organs as well as result in acute effects such as skin redness, hair loss, radiation burns, or acute radiation syndrome beyond certain thresholds. These effects of radiation are more severe at higher doses and rates [3].

Chronic effects of ionizing radiation depends on the total radiation dose but is also affected by other factors such as environmental and genetic makeup. Induction of future

cancer is the greatest fear, however other potential outcomes include hereditary effects, shortening of life span, and cataract formation in the eyes. Radiation-induced cancers may develop decades after exposure, and include myeloma, leukemia, lung cancer, thyroid cancer, breast cancer, bone cancer, and skin cancer.This risk is higher for children and adolescents, as they are significantly more sensitive to radiation exposure than adults [2].

Different diagnostic and interventional procedures use lower doses of ionizing radiation but still however may cause DNA damage that increases the risk for future cancer. The International Commission on Radiological Protection (IRCP) estimates that after an average person receives a whole-body radiation dose of 1 Sv, they have a 4 to 5 percent increased relative risk of fatal cancer [3, 4].

Prenatal exposure to ionizing radiation may induce brain damage in fetuses following an acute dose exceeding 100 mSv between weeks 8-15 of pregnancy and 200 mSv between weeks 16-25 of pregnancy. Epidemiological studies indicate that the cancer risk after fetal exposure to radiation is similar to the risk after exposure in early childhood [3].

1. 2. Statement of the Problem

The medical use of ionizing radiation is by far the largest single contributor to population exposure from artificial sources. Annually worldwide, there are more than 3,600 million X-ray examinations, around 10% of these occur in children, 37 million nuclear medicine and 7.5 million radiotherapy procedures. Each year about 7 million health workers incur radiation doses attributable to their occupation across the world [5].

Previous studies in United Kingdom show that 100-250 death per year occurred because of harmful effects of medical radiation exposure. The 2006 Biological Effects of Ionizing Radiation (BEIR) VII lifetime attributable cancer risk model predicts that 1 in 1000 persons exposed to 10 mSv will develop cancer due to that single exposure. This measurement is in the range of a single diagnostic CT scan of the neck, chest, abdomen, or pelvis; . One study assessed the risks of developing a fatal cancer from CT scanning in the pediatric population and estimated the lifetime attributable cancer mortality risk attributable to a single radiation exposure in a one year-old child to be 1 in 550 following an abdominal CT and 1 in 1500 following a brain CT. These findings equate to a 0.35 percent increase in cancer deaths over the present background rate [6-8].

WHO's Global initiative on radiation safety in health care settings identified various factors impacting safe use of radiation in medicine. These include limited data on population exposures, needs of vulnerable groups, fragmented care, unnecessary exposures, unintended exposures and occupational radiation protection issues [5].

Similar to many developing countries, the health care system in our country faces many challenges. The shortage of physicians and lack of resources as well as fragmentation of care when patients are referred from one health facility to another with different providers involved in their care who are not always aware of previous workups or treatment given have the greatest impact on patient care. In addition to these, optimal clinicians' knowledge in a field that is forever advancing is essential in improving the health care provided.

Most researches done world wide as well as in our country also indicate that there's lack of knowledge regarding risk from radiologic imaging among physicians and medical students. However, no such study was conducted at SPHMMC and available information about attitude and practices regarding safety measures against radiation are inadequate [8-20].

1. 3. Significance of the study

St. Paul's hospital millennium medical college is the second largest referral hospital in Ethiopia that is expanding at an astonishing rate. It is one of the few governmental hospitals that have facilities for CT-Scan, MRI as well as interventional radiology in the country. It services thousands of patients per day and radiologic tests parallel this workload. Students of SPHMMC take a three week course on radiology that mainly focuses on image interpretation during their undergraduate study. It is therefore essential to closely look at students' and interns' awareness regarding radiation exposure to common diagnostic imaging procedures as they are the future general practitioners spread across the country who will investigate and manage patients with any available resource.

In addition, there is a lack of studies in Ethiopia about the hazards of unnecessary use of radiological examinations. To my knowledge, such a study was never conducted in SPHMMC and there are only three studies in Ethiopia among medical doctors on the knowledge and awareness of radiation exposure during common radiological procedures and the results were poor [8,9,16].

Hence, it is extremely important to consider the safety of both the patient and the medical professional performing the radiological procedure. This study aimed to assess SPHMMC clinical year medical students and interns' knowledge, attitude and practice regarding radiation exposure to common diagnostic imaging procedures. The results of this study serve to generate baseline information on physicians' knowledge on ionizing radiation. It also helps guide to improve the institutions' practices regarding protection from radiation to better services for the patient in addition to safer workplace for health workers.

2. Literature Review

A study done in the year 2009 in Australia involved fourth to sixth year medical students enrolled at a western Australian university and interns from three teaching hospitals in Perth. The study showed lack of awareness of ionizing radiation from diagnostic imaging among senior medical students and interns. The mean score on a knowledge test was 6.0 out of a possible maximum of 19 (31.6%). Interns scored significantly higher than medical students with a mean score of 6.9 showing that awareness increased with seniority. Among the participants, 11.3% and 25.5% incorrectly believed that ultrasound and MRI, respectively, emit ionizing radiation. It was discerning that 11.2 % of the participants believed that such knowledge was either 'not really important' or 'not important at all'. The results of the study emphasized the need for improved education in order to minimize unnecessary exposure of patients and the community to radiation [10].

A study conducted among final year medical students in Norway in 2017 reported that the knowledge of radiation dose and the risks associated with ionizing imaging among medical students was low with The total mean score of 3.91 out of possible 11. Only 18 % of the students scored more than five points (50%). It's also noteworthy that the majority of the students (83%) reported that they had received lectures about ionizing radiation during their study. However, only 39% of students indicated that these lectures were focused on radiation dose and risks [13].

A study in Italy with the title awareness of radiation protection and dose levels of imaging procedures among medical students, radiography students and radiology residents at an academic hospital: results of a comprehensive survey in the year 2016 concluded that radiology residents, radiography students and medical students have a limited knowledge about radiation exposure, with a specific gap of knowledge concerning real radiation doses of daily radiological examinations. The actual knowledge of essential radiation protection topics such as regulations, patient and tissue susceptibility to radiation damage, professional radiation risk and dose optimization as well as radiation doses delivered by common radiological procedures was significantly worse among medical students than radiology residents and radiography students [14].

Another study done on doctors' and intern doctors' knowledge about patients' ionizing radiation exposure doses during common radiological examinations in turkey in the year 2007. 93.1% of the participants underestimated the actual dose while 4% and 27.4% of

them did not know that ultrasound and MRI, respectively do not emit ionizing radiation. Overall, the study indicated the inadequate level of knowledge of the participants [11].

A study done in 2016 on knowledge, attitude and practices regarding radiological modalities among health-care providers in Pakistan reported that they had appropriate knowledge, positive attitude but unsafe practices due to lack of facilities in public sector hospitals. The results were in contrast with the level of radiological knowledge found in other studies that suggested that knowledge of radiation exposure from radiological investigations and the associated risk among interns, residents and radiographers was lacking. The study attributed the appropriate knowledge find to the 5 years integrated curriculum that included instruction in clinical radiology suggesting their understanding and knowledge of the basic concepts central to radiation protection has proven very knowledgeable for the undergraduates. The study also revealed negative practice of young doctors for ordering least hazardous investigation for their patient and that they had limited concern about risks of radiation exposure [21].

Similar studies conducted in Palestine, northern Ireland , United kingdom as well as Saudi Arabia revealed varying level of knowledge regarding radiation doses, responsibility of referrers and risk to patient safety but was over all significantly limited in all groups [17-20].

A different study in Turkey done in 2013 evaluated the knowledge, perception and mitigation of hazards involved in radiological examinations. It focused on health-care personnel who are not in radiation-related occupations, but who use ionizing radiation as a part of their work. The study included physicians, nurses, technicians and other staff working in different clinics that use radiation in their work. It demonstrated that general knowledge in relation to radiation, radiation protection, health risks and doses used for radiological applications are insufficient among health professions using ionizing radiation in their work. Only 21.6% of the participants reported that they considered the ionizing radiation dose for general radiological applications to be moderately safe, and more than the half said that they had no knowledge of this matter. The participants also reported that they would like to learn more about safety measures, the safe dose of radiation and the action to be taken in the case of a radiation accident [12].

A different study done in Egypt Suez Canal University Hospital that assessed physicians' knowledge, attitude and practices of radiation safety in 2015 concluded that physicians'

had deficient knowledge, unsafe practices and negative attitude towards radiation safety polices & precautions. It also showed that majority of the participants did not receive any radiation safety-related training. The study included radiologists, oncologists, surgeons and orthopedists. Among these, it was identified that radiologists and oncologists were exposed to ionizing radiation more frequently but their knowledge was as low as that of other physicians [15].

A study assessing Medical Doctors' Knowledge about Patients' Ionizing Radiation Exposure Dose and Its Associated Risks at Jimma University Specialized Hospital in Ethiopia was conducted in 2016. The study included interns, general practitioners, residents as well as senior consultant doctors. Findings from the study showed limited knowledge of doctors about radiation exposure and risks associated with diagnostic imaging modalities. it revealed that doctors could not appropriately estimate radiation doses in the field of plain radiography, contrast studies and CT examinations. Most of the doctors either under estimate the dose or did not know the dose. Correct estimates of the radiation dose were given for, abdominal x-ray, bone scan and ankle x-rays by 7.3% to 8.2% of the respondents. The doses associated with PET scan, barium meal and Abdomen CT were also only accurately estimated by 3.6%, 6.4% and 10% of the participants respectively. 23.6% of the participants were incorrect in their assumption that abdominal ultrasound examinations involved the use of ionizing radiation, whereas 10% wrongly thought that an abdominal MRI used ionizing radiation. 17.3% of the participants did not know whether abdominal US involves ionization radiation or not [8].

A Study done in 2013 at Tikur Anbessa Teaching Hospital in Addis Ababa assessed Final-Year Medical Students and Interns Awareness of Radiation Exposure to Common Diagnostic Imaging Procedures. Among the respondents, 78.9% of them either underestimated or do not know the radiation dose of commonly requested imaging. Surprisingly, 71.4% and 79.3% of students incorrectly believed that ultrasound and MRI, respectively, emit ionizing radiation or they do not know if they emit radiation or not. Study also showed that there was no significant difference in the knowledge ionizing radiation between interns and medical students. It's also important to note that only 34.8% of the participants acknowledged that they had some form of education on ionizing radiation previously either in the form of lectures, tutorials, workshops or a combination of these [9].

A similar study was previously done in Tikur Anbessa teaching hospital that aimed to assess knowledge about awareness of physicians about radiation dose and hazards of radiation in the year 2012. while the study included interns, GP's, residents and consultants, the results were similar to the above mentioned study as it suggested that clinicians' awareness of radiation doses of common radiological procedures and the consequent risk to the individual patient is poor. A major curriculum revision of both undergraduate and graduate medical education regarding awareness on radiation was recommended to improve this deficiency [16].

3. Objectives

3. 1. General Objectives

To assess knowledge, attitude and practice of SPHMMC medical students and associated factors regarding radiation exposure to common diagnostic imaging procedures from March 12, 2018 G.C. to June 15, 2018 G.C.

3. 2. Specific Objectives

1. To determine the knowledge regarding radiation exposure to common diagnostic imaging procedures among SPHMMC clinical year medical students and interns from March 12, 2018 G.C. to June 15, 2018 G.C.
2. To assess attitude towards radiation exposure to common diagnostic imaging procedures among SPHMMC clinical year medical students and interns from March 12, 2018 G.C. to June 15, 2018 G.C.
3. To examine the practice of protection from radiation exposure to common diagnostic imaging procedures among SPHMMC clinical year medical students and interns from March 12, 2018 G.C. to June 15, 2018 G.C.
4. To identify associated factors of knowledge, attitude and practice regarding radiation exposure to common diagnostic imaging procedures among SPHMCC clinical year medical students and interns from March 12, 2018 G.C. to June 15, 2018 G.C.

4. Methodology

4. 1. Study Setting

St. Paul's Hospital Millennium Medical College is the second largest referral hospital in our country that has 800 undergraduate medical students. Currently the hospital is advancing its medical training in undergraduate, post graduate and fellowship programs in addition to expanding medical services with the first center for kidney transplantation and future hematology, cardiology as well as oncology center already under construction. Radiology in SPHMMC is one of the expanding specialty departments that also has post graduate and fellowship programs including interventional radiology. It is one of the few governmental hospitals that has resources for CT scan and MRI as well as interventional radiology where more than 25 CT scans, 90 x-rays & 30 MRI are done per day on average during working days. The study was conducted at the Student Campus where the registrar, library, class rooms as well as dormitories are found as well as the hospital where clinical year students and interns were rotating in their respective attachments.

4. 2. Study design

A hospital based cross-sectional study was conducted on knowledge, attitude and practice regarding radiation exposure to common diagnostic imaging procedures among clinical year medical students and interns of SPHMMC.

4. 3. Study Period

The study was conducted from March 12, 2018 to June 15, 2018.

4. 4. Populations

Source population: All clinical year medical Students and interns at SPHMMC

Study Population: Sampled clinical year medical students and interns at SPHMMC who fulfills the inclusion and exclusion criteria

Inclusion Criteria: Sampled clinical year medical students and interns at SPHMMC who were not on week offs, research leave, attachment outside of SPHMMC & AaBET, annual break or otherwise unavailable

4. 5. Sample size & Sampling procedures

Sample size is calculated using single population proportion formula using different previous researches.

Estimated proportion of knowledge of 9.80% was taken from a research done in Tikur Anbessa hospital. Any particular outcome was to be within 5% marginal error and 95% confidence interval (CI) of certainty with the resulting sample size being 107.[9]

Estimated proportion of attitude of 23.7% was taken from a research done in EGYPT. Any particular outcome was to be within 5% marginal error and 95% confidence interval (CI) of certainty with the resulting sample size being 179.[15]

Estimated proportion of practice of 41.2% was taken from a research done in EGYPT. Any particular outcome was to be within 5% marginal error and 95% confidence interval (CI) of certainty with the resulting sample size being 213. [15]

The largest calculated sample size was taken for this research, i.e. magnitude of good practice of 41.2% (p) from related study conducted in Egypt on Physicians' Knowledge, Attitude and Practices of Radiation Safety at Suez Canal University Hospital with 95% confidence interval rate, 5% marginal error(d), and 10% for non-response rate. Sample Size for cross sectional study with N less than 10,000:

$$n = \frac{\frac{Z^2 p(1-p)}{d^2}}{1 + \frac{1}{N}\left(\frac{Z^2 p(1-p)}{d^2} - 1\right)}$$

Z= 1.96 p= 0.41 d= 5% or 0.05

N= 493 (Number of undergraduate clinical year medical students and interns at SPHMMC in total)

$$n = \frac{1.96^2 \cdot x\ 0.41\ (1-0.41)}{0.05^2}$$

$$1+1/493\ \left(\frac{1.96^2 \cdot x\ 0.41\ (1-0.41)}{0.05^2} - 1\right)$$

$= \frac{371.71}{1.733}$

$= 214.49$

n= 215

With 10% non-response rate, the final sample size was 237.

Convenience method of sampling was employed among 3rd. 4th and 5th year medical students as well as interns from March 12 to June 15, 2018 G.C.

4. 6. Measurement

4. 6. 1. Variables

Independent variables

- Age
- Sex
- Level of education
- Clinical attachment to radiology department
- Confidence with knowledge
- Perceived importance
- Preferred method of education

Dependent variables

- Knowledge
- Attitude
- Practice

4. 6. 2. Data collection instruments

A structured self administered questionnaire was prepared by reviewing studies on the topic of interest containing 16 questions that assess knowledge, 10 questions that assess practice, 15 questions that assess attitude and two questions regarding form of education.

4. 7. Data collection process

Questionnaire was prepared by the principal investigator through referring published researches done worldwide on similar topics. The format was commented and approved by respective advisers before data collection. Data collection began after acquisition of written consent to undertake the study and data was collected and documented according to prepared questionnaire. Questionnaires were distributed after lectures for 3rd and 4th year clinical students and at the library for available 5th year medical students who were in the middle of qualification exam at the time. The questionnaires were also distributed among interns during morning sessions of OBGYN, Pediatrics, Surgery, Internal Medicine, Psychiatry, Orthopedics and Emergency medicine at SPHMMC and AaBET. Collected data did not include participants name and is only be available to the researcher.

4. 8. Data Quality control

Questionnaire was prepared by reviewing questionnaires of previous researches on similar topic and modified for current study. It was also commented and approved by respective advisers before data collection. The questionnaire was pre-tested on 12 clinical year medical students and interns which was proportional to 5% of calculated sample size. Data was collected in person by the principal investigator and checked for completeness and internal consistency. Then, it was entered into SPSS version 20 software package (IBM Corporation, Armonk, NY, USA).

4. 9. Data processing and Analysis

Data from all the questionnaires was checked for completeness and coded. Incomplete or ambiguous data were left out. Datum that is complete was fed and analyzed by SPSS 20 for windows. Simple descriptive statistics such as frequency and percentage were used to summarize the results. Chi-square was used to describe the association between level of education, Clinical attachment to radiology department, Confidence with knowledge, perceived importance and knowledge, attitude, practice and preferred method of education. P-value < 0.05 was considered as statistically significant association. bi-variate regression was used for factors that showed significant association on chi-square and p-value of <0.2 was considered as statistically significant association for further multi-variable regression analysis.

4. 10. Ethical Consideration

Participants of the study were briefed about voluntary nature of the study and confidentiality issues. Informed written consent was obtained and questionnaires were distributed and collected by the principal investigator. Filled questionnaires were identified by their assigned identification number not by their names. The information collected is not discussed referring the student's name. The data was used only for the intended purpose of the study and only reviewed by the principal investigator. Approval from SPHMMC public health department and academic & research vice provost was received for this study prior to enrollment.

4. 11. Operational definition

In this study:

Knowledge: All the facts that an individual knows about the subject.

Good Knowledge: when respondents are able to answer greater than or equal to 50% of the total knowledge questions appropriately

Poor Knowledge: when respondents answer less than 50% of the total knowledge questions appropriately

Confidence with knowledge: participants' level of confidence in their knowledge of ionizing radiation dose of common radiological investigation.

Attitude: A way of thinking about something or behavior towards something.

Positive attitude: when respondents answer favorably to 50% or more of the questions for attitude.

Negative Attitude: when respondents answer unfavorably to more than 50% of questions for attitude.

Perceived importance: participants' belief towards the degree of importance of knowledge regarding radiation

Practice: Actual performance of an activity in real situation.

Good Practice: when respondents are able to answer greater than or equal to 50% of the total practice questions appropriately

Poor Practice: when respondents answer less than 50% of the total practice questions appropriately

4. 12. Dissemination of results

The findings of this research will be disseminated to the department of public health and department of radiology. It will also be made available to all undergraduate medical students of SPHMMC in hard copy in the institution's library.

5. Results

There were a total of 226 out of calculated 237 respondents included during this research making the non-respondent rate of this research 4.6%. four participants refused to participate in the study while seven participants were not able to return the questionnaire fully filled out.

5. 1. Socio-demographic Characteristics

Out of the total respondents, 96 (42.5%) were female while 130 (57.5%) were male. The minimum age of the respondents was 19 while the maximum was 26 with the median age being 23 years old. (Table 1)

Table 1: Age and Sex distribution of SPHMMC clinical year medical students and interns from March 12 to June 15, 2018 G.C

Characteristic	Label	Frequency	Percent
Age	19-22	100	44.20%
	23-26	126	55.80%
Sex	Male	130	57.50%
	Female	96	42.50%

5. 2. Academic & Clinical Characteristics

Among the participants; 82 interns participated comprising 36.3% of the respondents while 3rd ,4th , and 5th year medical students accounted for 25.7%, 22.6% and 15.5% of participants respectively. More than half (61.5%) of the participants have attached their clinical rotation of radiology. 92.9% of the participants have never taken radiation safety training (Table 2). 58.8% of the respondents stated that they are not exposed to radiation while 8% were exposed more than three times per week (Figure 1).

Table 2: Academic and clinical characteristics of SPHMMC clinical year medical students and interns from March 12 to June 15, 2018 G.C.

Characteristic	Label	Frequency
Clinical year	3rd Year	25.70%
	4th year	22.60%
	5th year	15.50%
	Interns	36.30%
Clinical rotation of radiology	Attached already	61.50%
	Haven't yet attached	38.50%
Radiation safety training	yes	7.10%
	No	92.90%

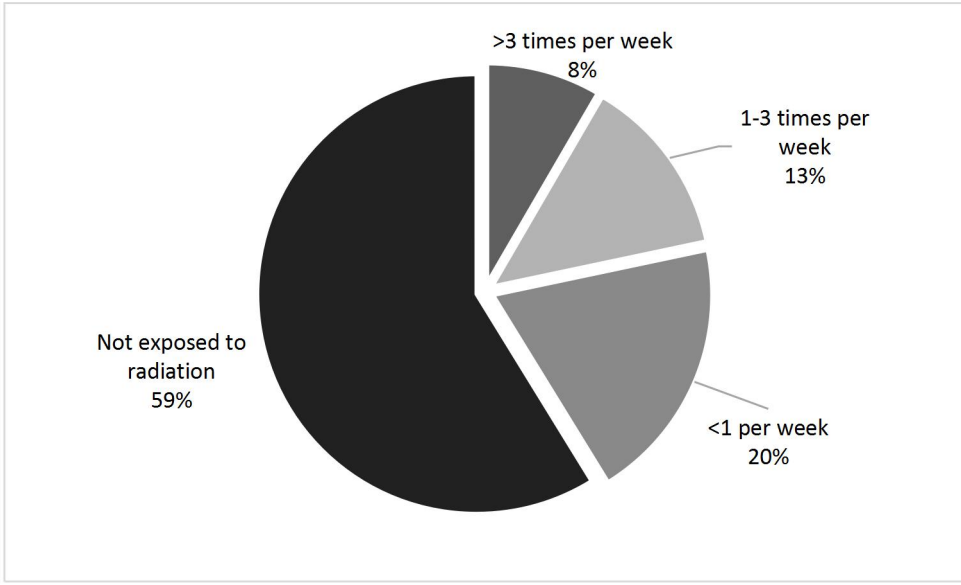

Figure 1: Distribution of SPHMMC Clinical year medical students and interns based on radiation exposure from March 12 to June 15, 2018 G.C.

5. 3. Knowledge about ionizing radiation

The study attempted to assess knowledge regarding radiation exposure to common diagnostic imaging among SPHMMC clinical year medical students and interns. Majority of the respondents had poor knowledge. Only four (1.8%) out of 226 respondents correctly answered more than 50% of questions related to knowledge in the study (Table 3). The mean score of respondents on knowledge test during this study was 2.5 out of possible 16 (15.6%) with the minimum & maximum score being zero and nine respectively.

Among the participants, 17.3% correctly identified the background radiation equivalent dose and only 4.9% correctly identified the radiation equivalent dose in chest X-ray. 29.6% and 24.3% of the respondents correctly identified that Abdominal ultrasound And Spine MRI had no radiation respectively. However, only 4% of the participants knew the correct risk of inducing fatal cancer from an abdominal CT while 97 (42.9%) correctly identified the gonads as the most sensitive organs to radiation. In terms of radiation awareness, 58.4% of the respondents acknowledged that they had some form of education on radiation exposure in the form of lectures (49.6%) and a combination of tutorials/workshops and lectures (8.8%). majority of the participants (68.1%) also answered that demonstrations would be their first choice of preferred type of education if they were to have a choice in the format of education for further radiation awareness.

Table 3: Overall knowledge result of participants regarding radiation exposure to common diagnostic imaging procedures from March 12 to June 15, 2018 G.C.

Academic Year		Poor knowledge	Good knowledge
3rd year	No of participants	58	0
	% of participants	100%	0%
4th year	No of participants	51	0
	% of participants	100%	0%
5th year	No of participants	35	0
	% of participants	100%	0%
Intern	No of participants	78	4
	% of participants	95.1%	1.8%

5. 4. Attitude regarding radiation safety

The study showed that most of the respondents had negative attitude and only 38 (16.8%) had positive attitude towards radiation exposure to common diagnostic imaging procedures (Table 4). Five (2.2%) of the respondents felt very confident in their knowledge of radiation dose of common radiological investigations and 26 (11.5%) of them felt moderately confident. However, 106 (46.9) of the participants answered they were not really confident and 89 (39.4%) felt they had no idea about ionizing radiation. Majority of the participants (80.1%) agreed that knowledge of radiation dose in medical practice was important.

Fifty one students and interns (22.5%) thought that policies and procedures for radiation protection in their hospital were clear and easily understood and 38.9% felt neutral, while 27.9% thought they were confident about the radiation protection precautions and 34.5% felt neutral. 92 participants (40.7%) knew whom to contact if they have any questions regarding radiation precaution. However 75.2% of the participants felt they could not clearly explain precautions required for caring their patients and visitors. Moreover, only 14.2%% felt safe while caring their patients needing radiological investigations, and 22.6% felt that policies and procedures in the hospital were based on up to date regulations . Finally, only 9.7% felt confident that their institution carefully monitor their exposure to radiation. Many of the respondents ranging from 42.0% to 48.2% answered don't know to the applicability and practical use of different personal protective equipment during radiological procedures.

Table 4: Attitude of SPHMMC clinical year medical students and interns regarding radiation safety from March 12 to June 15, 2018 G.C.

Academic year		Poor attitude	good attitude
3rd year	No of participants	51	7
	% of participants	87.90%	12.10%
4th year	No of participants	37	14
	% of participants	72.50%	27.50%
5th year	No of participants	32	3
	% of participants	91.40%	8.60%
Intern	No of participants	68	14
	% of participants	82.90%	17.10%

5. 5. Practice of radiation safety

Practice of radiation safety was assessed by examining use of protective personal equipment, minimal endoscopic time and distance from x-ray device during radiological procedure. Only 15.9% of the students and interns had good practice of radiation safety (Table 5). Among the participants, majority of them either never used protective equipment or stated they didn't know. 50% of the respondents also answered don't know to using minimal endoscopic time. However, 82.7% stay in the operating room or at a distance of 2 meters or more from the source of radiation (Figure 2).

Table 5: Practice of radiation safety measures among SPHMMC clinical year medical students and interns from March 12 to June 15, 2018 G.C.

Academic year		Poor practice	Good practice
3rd year	No of participants	49	9
	% of participants	84.50%	15.50%
4th year	No of participants	31	20
	% of participants	60.80%	39.20%
5th year	No of participants	34	1
	% of participants	97.10%	2.90%
Intern	No of participants	76	6
	% of participants	92.70%	7.30%

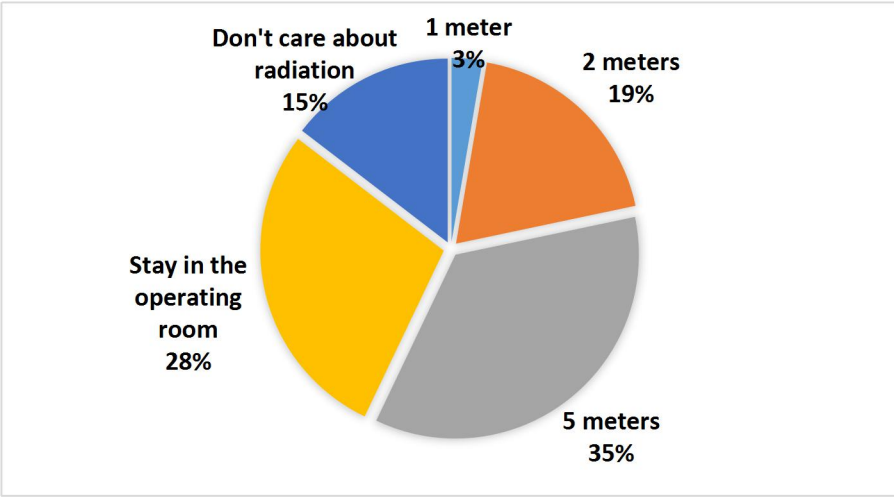

Figure 2: Distribution of respondents based on distance from X-ray device without protection

5. 6. Associations between knowledge, attitude and practice of SPHMMC clinical year medical students and interns regarding radiation exposure to common diagnostic imaging

Chi-square test, bi-variate and multi-variable logistic regression analyses were computed to assess correlation between age, sex, academic year, radiology attachment, confidence in knowledge, perceived importance, knowledge, attitude and practice.

Chi-square test showed significant association between age, sex, confidence in knowledge, perceived importance and attitude of clinical year medical students and interns regarding radiation safety. It also showed that Academic year, confidence in knowledge, perceived importance and practice of safety measures among clinical year medical students and interns had significant association (Table 6). However, there was no significant association between the variables and knowledge of SPHMMC clinical year medical students and interns regarding radiation exposure to common diagnostic imaging (Table 7). P-value < 0.05 was considered as statistically significant association.

Table 6: Association between variables and attitude & practice of SPHMMC clinical year medical students and interns regarding radiation exposure from March 12 to June 15, 2018 G.C using chi-square test

Variables		Attitude			Practice		
		Positive Attitude	Negative Attitude	P-Value	Good Practice	Poor Practice	P-Value
		n (%)	n (%)		n (%)	n (%)	
Age				**0.004**			0.100
	19	2 (100%)	0 (0%)		0 (0%)	2 (100%)	
	20	0 (0%)	9 (100%)		0 (0%)	9 (100%)	
	21	6 (16.7%)	30 (83.3%)		5 (13.9%)	31 (86.1%)	
	22	4 (7.5%)	49 (92.5%)		15 (28.3%)	38 (71.7%)	
	23	12 (32.4%)	25 (67.6%)		8 (21.6%)	29 (78.4%)	
	24	10 (19.6%)	41 (80.4%)		5 (9.8%)	46 (90.2%)	
	25	4 (15.4%)	22 (84.6%)		3 (11.5%)	23 (88.5%)	
	26	0 (0%)	12 (100%)		0 (0%)	12 (100%)	
		X^2 value = 19.43			X^2 value = 11.23		
Sex				**0.012**			0.715
	Female	9 (9.4%)	87 (90.6%)		14 (14.6%)	82 (85.4%)	
	Male	29 (22.3%)	101 (77.7%)		22 (16.9%)	108 (83.1%)	
		X^2 value =6.60			X^2 value = 0.23		

Academic Year			0.077			**0.000**
3rd year	7 (12.1%)	51 (87.9%)		9 (15.5%)	49 (84.5%)	
4th year	14 (27.5%)	37 (72.5%)		20 (39.2%)	31 (60.8%)	
5th year	3 (8.6%)	32 (91.4%)		1 (2.9%)	34 (97.1%)	
Intern	14 (17.1%)	68 (82.9%)		6 (7.3%)	76 (92.7%)	
	X^2 value = 6.763			X^2 value = 29.67		
Attached radiology			0.102			0.853
Yes	28 (20.1%)	111 (79.9%)		23 (16.5%)	116 (83.5%)	
No	10 (11.5%)	77 (88.5%)		13 (14.6%)	74 (85.1%)	
	X^2 value = 2.86			X^2 value = 0.10		
Confidence In knowledge						**0.001**
Very Confident				2 (40.0%)	3 (60.0%)	
Moderately Confident				10 (38.5%)	16 (61.5%)	
Not really Confident				22 (20.8%)	84 (79.2%)	
No idea about ionizing radiation				2 (2.2%)	87 (97.8%)	
				X^2 value = 13.92		
Perceived Importance			**0.042**			**0.000**
Very important	25 (16.9%)	123 (83.1%)		18 (12.2%)	130 (87.8%)	
Moderately important	10 (30.3%)	23 (69.7%)		9 (27.3%)	24 (72.7%)	
Not really important	3 (20.0%)	12 (80.0%)		7 (46.7%)	8 (53.3%)	
Not important at all	0 (0%)	2 (100%)		2 (100%)	0 (0%)	
Don't know	0 (0%)	28 (100%)		0 (0%)	28 (100%)	
	X^2 value = 4.13			X^2 value = 26.40		

Table 7: Association between variables and knowledge of SPHMMC clinical year medical students and interns regarding radiation exposure to common diagnostic imaging procedures from March 12 to June 15, 2018 G.C. using chi-square test

Variables	Knowledge		P-Value
	Good Knowledge	Poor Knowledge	
	n (%)	n (%)	
Age			0.458
19	0 (0%)	2 (100%)	

20	0 (0%)	9 (100%)	
21	0 (0%)	36 (100%)	
22	0 (0%)	53 (100%)	
23	2 (5.4%)	35 (94.6%)	
24	2 (3.9%)	49 (96.1%)	
25	0 (0%)	26 (100%)	
26	0 (0%)	12 (100%)	
	X^2 value = 6.84		
Sex			1.000
Female	2 (2.1%)	94 (97.9%)	
Male	2 (1.5%)	128 (98.5%)	
	X^2 value = 0.94		
Academic Year			0.111
3rd year	0 (0%)	58 (100%)	
4th year	0 (0%)	51 (100%)	
5th year	0 (0%)	35 (100%)	
Intern	4 (4.9%)	78 (95.1%)	
	X^2 value = 4.31		
Attached radiology			0.301
Yes	4 (2.9%)	135 (97.1%)	
No	0 (0%)	87 (100%)	
	X^2 value = 2.55		
Confidence In knowledge			1.000
Very Confident	0 (0%)	5 (100%)	
Moderately Confident	0 (0%)	26 (100%)	
Not really Confident	4 (3.8%)	102 (96.2%)	
No idea about ionizing radiation	0 (0%)	89 (100%)	
	X^2 value = 4.16		
Perceived Importance			0.587
Very important	2 (1.4%)	146 (98.6%)	
Moderately important	2 (6.1%)	31 (93.9%)	
Not really important	0 (0%)	15 (100%)	
Not important at all	0 (0%)	2 (100%)	
Don't know	0 (0%)	28 (100%)	
	X^2 value = 4.88		
Attitude			1.000
Positive attitude	0 (0%)	38 (100%)	
Negative Attitude	4 (2.1%)	184 (97.9%)	
	X^2 value = 0.82		
Practice			1.000
Good practice	0 (0%)	36 (100%)	
Poor practice	4 (2.1%)	186 (97.9%)	
	X^2 value = 0.77		

bi-variate and multi-variable logistic regression were used to further analyze the correlation between variables. Females were found to be 2.77 times more likely to have poor attitude towards radiation safety as compared to males using bi-variate logistic regression (COR 2.776, CI 1.246 - 6.183). multi-variable regression however showed no significant association between the two variables with a p value of p = 0.097(Table 8).

4th year clinical medical students are 10 times more likely to have good practices of protective measures against ionizing radiation as compared to interns with p value of 0.000 (AOR10.011, CI3.154 - 31.771). bi-variate regression showed that clinical year medical students and interns who had no confidence in their knowledge are 4 times more likely to have poor practice as compared to those who have confidence in knowledge with p value of 0.000 (COR 4.5, CI 1.994 - 10.419). however multi-variable regression showed no such statistically significant association (Table 9). there's significant association between attitude and practice of respondents. Out of the participants , those who had negative attitude towards Radiation safety were 13 times more likely to have poor practice (AOR 13.289, CI 4.693 - 37.630) (Table 9).

Table 8: Association between selected variables and attitude of SPHMMC clinical year medical students and interns regarding radiation safety from March 12 to June 15, 2018 G.C

Variables		Attitude		Crude ORs & 95% CI for Exp(B)	Adjusted ORs & 95% CI for Exp(B)
		Positive Attitude	Negative Attitude		
Age				0.97,[0.778 - 1.208], P = 0.782	
Sex	Female	9	87	2.776, [1.246 - 6.183], **P = .012**	2.103, [0.873 - 5.064], P = 0.097
	Male	29	101	1	1
Perceived Importance	Not Important	3	42	0.298, [0.087 - 1.017], **P = 0.053**	
	Important	35	146	1	

Table 9: Association between selected variables and practice of radiation safety among SPHMMC clinical year medical students and interns from March 12 to June 15, 2018 G.C

Variables		Practice		Crude ORs & 95% CI for Exp(B)	Adjusted ORs & 95% CI for Exp(B)
		Good Practice	Poor Practice		
Academic Year	3rd year	9	49	0.430, [0.144 - 1.283], **P = 0.130**	
	4th year	20	31	0.122, [0.045 - 0.334], **P = 0.000**	10.01, [3.154 -31.771] **P = 0.000**
	5th year	1	34	2.684, [0.311 - 23.16], **P = 0.369**	
	Intern	6	76	1	1
Confidence in Knowledge	Not Confident	24	171	4.5, [1.994 - 10.419], **P = 0.000**	1.256, [0.385 - 4.099], P = 0.706
	Confident	12	19	1	1
Perceived Importance	Not Important	9	36	0.701, [0.304 - 1.620], P = 0.406	
	Important	27	154	1	
Attitude	Positive Attitude	20	18	1	1
	Negative Attitude	16	172	11.944, [5.275 - 27.046], **P = 0.000**	13.289, [4.693 - 37.630], **P = 0.000**

6. Discussion

The findings of this research indicate that clinical year medical students and interns have inadequate knowledge about ionizing radiation as well as negative attitude and poor practice towards radiation safety. This is similar to various studies that showed deficiency in knowledge among medical students, doctors as well as dentists regarding ionizing radiation. Such limited knowledge of medical doctors can affect care of patients in terms of comparing expected benefits against potential risks. In addition to knowledge, attitude towards radiation safety and practice of protective measures is crucial for providing medical care without unnecessary additional risk to the patient or physician.

This study focuses on a number of issues useful for assessing the knowledge of clinical year medical students and interns regarding radiation exposure as well as their attitude and practice towards radiation safety. The limitations of the study include that this research deals only with medical students and interns of SPHMMC and the method of sampling was convenience method due to limitation of resources and difficulty of contacting participants who were selected using probability sampling method. Among the participants, majority of them had no or minimal exposure to radiation giving limited information to assess respondents' practice of radiation safety. Third year clinical year medical students who haven't yet attached to clinical rotation of radiology were included in the study. Another limitation of this research is that it was a self-administered questionnaire based study. The questionnaire was not a standard tool but prepared after reviewing various previous researches. The strength of the study were that the respondent rate was 95% and questionnaire was pre-tested on students.

The study results align with previous studies that showed physicians' knowledge toward radiation exposure is poor. The mean score of respondents on knowledge test during this study was 2.5 out of possible 16 (15.6%) which is lower than that of the study done in Australia that involved fourth to sixth year medical student whose mean score on a knowledge test was 6.0 out of a possible maximum of 19 (31.6%).This can be due to difference in educational curriculum and delivery of medical education. [10]

The study also revealed that Medical students and interns had limited knowledge regarding radiation dose of commonly requested radiological investigations. Out of the participants, 6.6%, 15% and 8.4% correctly estimated the dose for abdominal x-ray, ankle x-ray and Abdominal CT respectively. Only 29.6% and 24.3% knew that

Abdominal ultrasound and MRI had no ionizing radiation. These results are comparable to a study assessing Medical Doctors' Knowledge about Patients' Ionizing Radiation Exposure Dose and Its Associated Risks at Jimma University Specialized Hospital. Findings from the study showed doctors could not appropriately estimate radiation doses in the field of plain radiography, contrast studies and CT examinations. Correct estimates of the radiation dose were given for, abdominal x-ray and ankle x-rays by 7.3% of the respondents in both instances. Abdomen CT were also only accurately estimated by 10% of the participants. 23.6% of the participants were incorrect in their assumption that abdominal ultrasound examinations involved the use of ionizing radiation, whereas 10% wrongly thought that an abdominal MRI used ionizing radiation. 17.3% of the participants did not know whether abdominal US involves ionization radiation or not. The higher proportion of participants who incorrectly thought MRI and abdominal US used ionizing radiation in this study as compared to the above mentioned study at Jimma can be explained by difference in sampled population. The participants of the study done at Jimma University Specialized Hospital were all interns and physicians while this study included clinical year medical students who have far less exposure to different imaging modalities in clinical practice. [8]

Another Study done at Tikur Anbessa Teaching Hospital in Addis Ababa assessed Final-Year Medical Students and Interns Awareness of Radiation Exposure to Common Diagnostic Imaging Procedures also showed that students and interns had lacking knowledge in the subject matter. Majority of the respondents, 78.9% of them either underestimated or do not know the radiation dose of commonly requested imaging while 71.4% and 79.3% of students incorrectly believed that ultrasound and MRI, respectively, emit ionizing radiation or they do not know if they emit radiation or not. The above figures are similar to the findings of this study. [9]

This study revealed that 22.5% of the respondents thought policies & procedures on radiation precaution are easily available & understandable while 24.9% felt confident about the radiation protection precautions. 4.07% of the respondents knew who to contact for any questions regarding radiation while only 14.2 % felt safe while caring for patients needing radiological investigations. The study also revealed that only 24.8% of the participants felt they were clearly able to explain radiation precautions needed to patients and visitors. To compare these figures to a study done in Egypt Suez Canal University Hospital, it showed 65% of physicians thought that policies and procedures

for radiation protection in their hospital were clear and easily understood, while 61.3% thought they were confident about the radiation protection precautions. Forty seven physicians (58.8%) knew whom to contact if they have any questions regarding radiation Protection Moreover, only 27.5% felt safe while caring their patients needing radiological investigations. 50% of the respondents of the study felt they were clearly able to explain radiation precautions needed to patients and visitors. Less respondents in our study felt they can clearly explain precautions required for caring for their patients and visitors which can be related to poor tradition of disclosing potential risks of procedures and tests to patients in the day to day clinical practice in our setup. [15]

The practice of radiation safety of medical students and interns who participated in this study was shown to be poor with 34.1% to 38.1% of the participants having never used protective equipment and 46.9% to 50.4% stating they didn't know. This is similar to the study done in Egypt mentioned above where Only 57.5% of physicians were adherent to radiation protection policies, procedures and personal protective equipment. This result can possibly be related to limited resources of protective garments in required areas. [15]

Fourth year clinical medical students are 10 times more likely to have good practices of protective measures against ionizing radiation as compared to interns. This result could be due to lower proportions of 4^{th} year clinical students who are exposed to radiation as compared to interns. The study also revealed that Out of the participants , those who had negative attitude towards Radiation safety were 13 times more likely to have poor practice.

7. Conclusion & Recommendation

7. 1. Conclusion

Medical students and interns had limited knowledge regarding ionizing radiation and poor practice of protective measures as well as poor attitude regarding radiation safety. The study also showed that negative attitude towards radiation safety was associated with poor practice of protective measures.

7. 2. Recommendation

- To the scientific community

Further studies on medical students, practicing physicians, radiologists and radiology technicians are required to determine the optimum method of improving awareness among medical students as well as physicians.

- To department of radiology & higher administration

It will be beneficial if the department of radiology and undergraduate clinical coordinators incorporated more basic and background education regarding ionizing radiation to students during their clinical rotation. Interns as practicing physicians also need further education in the field in order to minimize unnecessary exposure to patients and a targeted better education regarding the risks of ionizing radiation associated with imaging modalities should be arranged. All medical students should receive a practical demonstration on protective measures during radiological procedures according to the protocol of the hospital either during clinical attachment to radiology or beginning of internship. Lastly, the department of radiology together with the administration of the hospital need to make all required protective equipment readily available and reinforce their use to all radiology technicians, attendants, students or interns who are present during radiological procedures.

8. References

1. Öztürk D, Yıldırım M, Kaya V, Duman E, Parlak E, Akarsu Z, Yalçın Y. Radiation Safety Awareness in Medical Staff. J Clin Anal Med 2015;6(4): 436-438.
2. Christoph IL, Joann GE,. Radiation-related risks of imaging studies, 2013. uptodate 21.6. Available from File:///E:/Medicine/UTD21.6/contents/mobipreview.htm?21/17/21785
3. WHO. Ionizing radiation, health effects and protective measures. Fact sheet updated April 2016
4. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP publication 103. Ann ICRP 2007; 37:1.
5. WHO: Global Initiative on Radiation Safety in Healthcare Settings Technical Meeting Report. December, 2008
6. Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation, National Research Council. Health risks from exposure to low levels of ionizing radiation: BEIR VII phase 2. The national academies press, Washington, DC; 2006.
7. Brenner D, Elliston C, Hall E, Berdon W. Estimated risks of radiation-induced fatal cancer from pediatric CT. AJR Am J Roentgenol 2001; 176-289.
8. Mesfin Z. , Elias K., Melkamu B. Medical Doctors' Knowledge about Patients' Ionizing Radiation Exposure Dose and Its Associated Risks at Jimma University Specialized Hospital, South West Ethiopia. International Journal of Scientific and Research Publications, 2017; 7(4) .
9. Seife TD, Daniel A, Yenework E. An Assessment of Final-Year Medical Students and Interns Awareness of Radiation Exposure to Common Diagnostic Imaging Procedures. Addis Ababa, Ethiopia. Hindawi Publishing Corporation Advances in Radiology, 2014.
10. Zhou GZ, Wong DD, Nguyen LK and Mendelson RM . Student and intern awareness of ionising radiation exposure from common diagnostic imaging procedures. Journal of Medical Imaging and Radiation Oncology, 2010; (2010) 17–23.

11. Zafar M, Farhan A, Shaikh T, Rafiq R, Usman S, Abrar H, et al. Knowledge, attitude, and practices regarding radiological modalities among health-care providers, Karachi, Pakistan. Int J Health Syst Disaster Manage 2016; 4:132-8.

12. Ayşegül Y, Berrin Ç, Türkan G. Evaluation of Awareness on Radiation Protection and Knowledge About Radiological Examinations in Healthcare Professionals Who Use Ionized Radiation at Work. Molecular Imaging and Radionuclide Therapy 2014;23(2): 48-53

13. Sundaran K. Awareness and knowledge of radiation dose and associated risks among final year medical students in Norway. Insights Imaging, (2017) 8:599–605.

14. Lorenzo F, Fabio P, Luca B, Davide G, Davide C. Awareness of radiation protection and dose levels of imaging procedures among medical students, radiography students, and radiology residents at an academic hospital: Results of a comprehensive Survey. European Journal of Radiology 86 (2017) 135–142

15. Rasha FA, Shaimaa AA, Ahmed MF, Amani WA. Assessment of Physicians' Knowledge, Attitude and Practices of Radiation Safety at Suez Canal University Hospital, Egypt. Open Journal of Radiology, 2015, (5), 250-258

16. Daniel Z , Seife TD, Tewodros A. A Study of Knowledge Awareness of Medical Doctors Towards Radiation Exposure Risk At Tikur Anbessa Specialized Referral And Teaching Hospital, Addis Ababa, Ethiopia. IOSR Journal of Pharmacy and Biological Sciences. 2012; 2 (4): 01-05

17. Hamarsheh A. ,Ahmead M. . Assessment of physicians' knowledge and awareness about the hazards of radiological examinations on the health of their patients. Eastern Mediterranean Health Journal. 2012; 18 (8)

18. Soye JA , Paterson A . A survey of awareness of radiation dose among health professionals in Northern Ireland. The British Journal of Radiology, 81(2008), 725–729

19. Selmi M, Natarajan MD (2016) Radiation Awareness amongst Junior Doctors. Journal of Advances in Radiology and Medical Imaging 1(2): 205. doi: 10.15744/2456-5504.1.205

20. Alotaibi AT and Alnafea MA. Radiation Dose Awareness among Radiology Staff. Austin Journal of Nuclear Medicine and Radiotherapy . 2017; 4(1): 1023.

21. Mubashir Z, Aroob F, Tooba S, Rida R, Salwa U, Hafsa A, et.al, editors. Knowledge, attitude, and practices regarding radiological modalities among health-care providers, Karachi, Pakistan. 2018.

9. ASSURANCE OF INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific , ethical and technical conduct of the research Project and for provisión of required progress reports as per terms and conditions of the Research and Publication Directorate or /and Department of Public Health of St Paul's Hospital Millennium Medical College.

Name of Student_____

Date_____Signature_____

Approval of Adviser(s)

Advisers	Signature	Date
Name :1. _____	_____	_____
2. _____	_____	_____

10. Annex

i. Consent

Dear respondent:

how are you? My name is Dr. Hanan Abdulrahman.. I'm here to execute a study titled-*knowledge, attitude and practice of SPHMMC clinical year medical students' and interns' regarding radiation exposure to common diagnostic imaging procedures*. I am asking for a few minutes of your time to participate in this study. The following questions are developed for the sake of gathering information in relation to the study. The information you give us will be very useful in the realization of this study, and it will be kept confidential. Your name and address will not be recorded. You have the rights to not answer questions which might be inconvenient for you. However, your information is very important for the study please read the questions carefully, be honest and complete them as applicable to you . Again we would like to confirm to you that all your answers are confidential and used for research purpose only.

I am willing to Participate: Yes ☐ No ☐

Thank you for your cooperation.

ii. Questionnaire

Please circle the appropriate answer; DN = Do not know

Personal information

1 Which one describes you best?

A 3rd year medical student
B 4th year medical student
C 5th year medical student
D Intern doctor

2 How old are you?

3 Sex:

A Female B Male

4 Have you attached to clinical rotation of radiology so far?

A Yes B No

Questions related to knowledge regarding radiation exposure

(The SI unit of ionizing radiation is Sieverts, Sv)

5 How much radiation in miliSieverts, mSv, is a person exposed to, on average, every year, from natural background radiation?

A 0.24
B 2.4
C 24
D 240
E DN

6 What is the approximate radiation dose, in mSv, on chest X-ray?

A 0.02
B 0.2
C 2
D 20
E DN

7 What is the dose in chest X-ray equivalents for the following radiological investigations?

Investigation Modality	0	1-5X	5-10X	10-50X	50-300X	> 300X	Don't know
Ankle X-ray							
Abdominal X-ray							
Abdominal US							
Bone Scan							
Barium Meal							
Spiral CT of abdomen							
Spine MRI							
PET Scan							

8 Please rate the following organs in terms of their sensitivity to ionizing radiation

Organs	Very sensitive	Moderately sensitive	Moderately insensitive	Very insensitive	Don't know
Ovaries/Testis					
Breast					
Skin/Cortical bone					
Lung/Colon					
Liver/Kidney/Bladder					

9 What is the risk of inducing fatal cancer from an abdominal CT scan?

A 1 in 200
B 1 in 2000
C 1 in 20,000
D 1 in 200,000
E DN

Questions related to practice of radiation safety

10 Have you ever taken radiation safety training?

A Yes

B No

11 Have you ever read a medical article about radiation safety? If yes how many?

A No

B Yes, 1 article

C Yes, 1 - 5

D Yes, >5

12 How often are you exposed to radiation every week?

A More than 3 times/week

B 1 - 3 times/week

C Less than one time per week

D I don't get exposed to radiation

13 How often do use the following radiation protection policies/equipment during radiological procedures? (If you are present in the imaging room assisting the patient during the procedure)

Measures	Always	Generally	Sometimes	Never	Don't Know
Lead aprons					
Thyroid shields					
Leaded Gloves					
Eye glasses					
Use minimal endoscopic time					
Increasing distance from X-ray device					

14 How far from the X-ray, do you stand without any protection during the radiological-guided procedure?

A 1 meter
B 2 meters
C 5 meters
D I always use stay in the operating room
E I do not care about the radiation

Questions related to Attitude regarding radiation exposure

15 How confident are you in your knowledge of ionizing radiation dose of common radiological investigation?

A Very confident
B Moderately confident
C Not really confident
D Do not have any idea about ionizing radiation

16 How important do you think is the need of knowledge of ionizing radiation dose of common radiological investigation in medical practice?

A Very important
B Moderately important
C Not really important
D Not important at all
E DN

17 What do think about applicability & practical use of protective clothes listed below?

Measures	Very good	Good	Poor	Very poor	Don't Know
Lead aprons					
Thyroid shields					
Leaded Gloves					
Eye glasses					

18 The policies and procedures on radiation precautions are easily available and easy to understand

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

19 I feel confident about the steps I need to take when caring for patients needing radiation precautions.

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

20 I know whom to contact if I have questions about what radiation precautions are needed for a particular patient

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

21 I feel I can clearly explain the radiation precautions needed to my patients and their visitors.

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

22 I feel safe when caring for patients needing radiation precautions

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

23 I feel the institutional policies and procedures are based on current regulations.

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

24 I feel confident the institution is carefully monitoring my radiation exposure.

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

25 I feel that I will be informed if I am at risk for higher than normal level of exposures

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

26 I feel that working with patients receiving radiation will not affect my ability to have a child.

A Strongly Disagree
B Disagree
C Neutral
D Agree
E Strongly Agree

Questions related to form of education

27 Have you ever had education in the form of lectures, tutorials, or courses regarding ionizing radiation?

A Lectures
B Tutorials/practical sessions
C A combination of the above two
D None

28 If you were to have a choice, which of the following kinds of education do you think would help you the most to raise awareness of ionizing radiation? (Select only one)

A Lectures
B Demonstrations
C Case studies
D Other: