Knowledge, Attitudes, and Practices of Ionizing Radiation Among Nurses In Jordan

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Abstract

This study aims to assess the levels of knowledge, attitudes, and practices towards ionizing radiation among male and female nurses working at governmental hospitals of the Jordanian Ministry of Health in the central region of Jordan. It also aims to examine the relationship between the levels of knowledge, attitudes, and practices towards ionizing radiation among nurses, taking into consideration a number of variables, such as work department, gender, age group, the educational level, years of experience, marital status and nationality. Methodology Across-sectional study was conducted on (472) male and female nurses working at seven governmental hospitals in the central region of Jordan. A four-part questionnaire was used. Then, the data were inserted and then analyzed by using an SPSS software, version (21), Chi square test, independent t-test, and ANOVA all of which were applied in order to determine if there is a statistically significant correlation between the variables of the study. Results an excellent level of knowledge was found among (91.7 %) of nurses. Furthermore, a good level of attitudes was found among (77.5%) of nurses and a good level of practices was found among (80.7%) of nurses. The largest number of participants was from Hamza Hospital, at which (95) participants were sampled (of the total sample). The minimum score obtained for knowledge was (3.9), while the maximum was (5.47). The mean score for the entire sample with a standard deviation was (7.8178 ± 1.593). Meanwhile, the minimum score obtained for attitudes was 1.258, while the maximum was (1.762). The mean score obtained with standard deviation was (2.5169 ± 1.344). However, the minimum score obtained for practices scores was (1.91) and the maximum was (2.671). The mean practice score for the entire sample with standard deviation was (3.8157 ± 1.4966). One-way-analysis of variance (ANOVA) revealed a statistically significant difference in the mean knowledge scores among the participants with different experience levels (p value=.048). Thereby, the class with more than (5) years of experience had the highest score. On other hand, those who had less than 1 year of experience had the lowest score (7.172± 1.33). Thus, the standard deviation was (1.4966). The mean attitude and practice scores were not statistically significant among nurses working in different departments. In addition, there was a statistically significant difference in practice scores between different age groups, (p=.013). Moreover, work departments were the most usually used sources of information about ionizing radiation for nurses who worked at government hospitals of the Jordanian Ministry of Health in the central region of Jordan. Conclusion and recommendations Nurses working at government hospitals of the Jordanian Ministry of Health in the central region of Jordan showed a general excellent overall knowledge and a good overall attitudes, and practices towards ionizing radiation. This was in turn influenced by the age variable and years of professional practice. In addition, most of the nurses did not attend programs of ionizing radiation during their study, so there is an urgent need to improve the curriculum content of ionizing radiation in nursing institutions. Moreover, nurses should also be encouraged to pursue further studies in order to keep up with the current trend of evidence based practice. Thereby, several seminaries and symposium are recommended on a regular basis within the hospitals to train all nurses about radiation protection.

I.   Background

Radiation is an important tool for diagnosis and treatment in medicine. The radioactive materials and x rays are used in most of medicine fields. It is linked with increased participations of a nurse with patients during radiological examinations and with nurse's increased exposure to radiation (NIOSH, 1977)."Today, nurses are exposed to radiation from diagnostic x-rays on a routine basis in a variety of settings related to health care environments. Those working in long term care facilities (LTC) are more likely to be exposed to radiation through the increased use of mobile x-ray services of LTC patients "(Dowed,1988,P:32).

The National Institute for Occupational Safety and Health (NIOSH) appeals that radiation protection is usually well-monitored in diagnosis by a radiation protection regulator NIOSH acknowledged; although, that

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nurses in departments where mobile x-rays are used, often accidentally, and insufficiently controlled for the effects of radiation exposure (U.S. Department of Health and Human Services, 1988).

Department of Health and Human Services standards for ionizing radiation are designed to protect the workers, public, and environment from the effects of radiation (American Nurse Association, 2015). Nurses are often the first; sometimes the only, point of contact for people whoseek medical care. Patient educator is one of the most important daily roles that nurses assume (Popet al., 1995). Nurses' practitioners play a significant role in assessing patients in departments and may request some x-ray examinations based on agreed protocols (Radiological Protection Center, 2001). The majority of nurses have received inadequate education about radiation hazards. For example, they cannot efficiently recognize and respond to the ionizing radiation hazards they might confront during their practices. Radiation exposure from radiographic examinations is an important security issue because it leads to an increased risk of cancer connected with recurrent radiation exposure (ICRP, 2007).

AIM OF THE STUDY
This study seeks to evaluate knowledge, attitudes and practices of ionizing radiation among nurses in the central region of Jordan. Moreover, it aims to investigate the demographic variables related to their level of knowledge, attitudes and practices regarding ionizing radiation among nurses.

STATEMENT OF THE PROBLEM
Nurses, various hospitals, or other health centers and units, such as Intensive Care Units, Cardiac Care Units, Operation rooms, Cardiac catheterization units, and Emergency units; where a portable x-ray is used .These are often inadequately controlled for the effect of radiation exposure.

The role of nurses in portable radiological procedures is therefore crucial as they mainly assess, prepare, or control patients during and after different imaging procedures (Campeau and Fleitze, 2010). However, these nurses are vulnerable to the effects of ionizing radiation hazards which in turn can be reduced by educating and training the staff about radiation protective measures for the purposes of eventually reducing radiation exposures (ICRP, 2007; Bushong, 2012).

Asmundsditir and Kaplan (2000), in their study pointed out the importance of empowering nurses with sufficient and precise information related to different aspects of radiation protection. This would be often helpful in delivering the correct information to those patients who are undergoing radiographic examination as well as protect nurses from unnecessary hazards of radiation.

Even during reviewing literature, it seems clear that most of the studies focused on physicians and radiographers, rather than on nurses. Meanwhile, this type of studies about (knowledge, attitudes, and practices was not investigated in Jordan).

Accordingly, the current study evaluated the baseline knowledge, attitudes, and practices of nurses working at Jordanian government hospitals of the Ministry of Health in the central region of Jordan.

SIGNIFICANCE OF THE STUDY
Exploring nurse's knowledge, attitudes, and practices of ionizing radiation is significant for different reasons. First, it encourages that several academic programs and researches should be conducted about ionizing radiation in nursing students' curricula in order to prepare a team of qualified professionals and eventually improve the nurses' knowledge, attitudes towards ionizing radiation.

Moreover, the identification of gaps in KAP towards ionizing radiation will inspire the development of health education and health promotion materials in order to eventually be used as a baseline study for future studies.

The results of the current study can be transferred to decision makers, health care policy in Jordan, and to ionizing radiation departments for the purpose of giving them a realistic image about the status question of the ionizing radiation in Jordan.
Consequently, and in cooperation with all relevant government hospitals, action can be taken so as to improve ionizing radiation practice among nurses.

RESEARCH HYPOTHESIS
1-There is a relationship between the level of the nurses' knowledge, and each of the following variables: age group, gender, the level of education, years of experience, work department, nationality, and social status.
2- There is a relationship between the level of the nurses' attitudes, and each of the following variables: age group, gender, the level of education, years of experience, work department, nationality, and social status.
3- There is a relationship between the level of the nurses' practices, and each of the following variables: age group, gender, the level of education, years of experience, work departments, nationality, and social status.
4- There is a relationship between nurses' KAP levels.

RESEARCH QUESTIONS

1-What is the nurses' knowledge level about ionizing radiation in the central region of Jordan?

2- What are the nurses' attitudes towards ionizing radiation in the central region of Jordan?

3- How do nurses practice protection measures to protect themselves from the risks of ionizing radiation in the central region of Jordan?

4-What is the relationship between KAP as a whole?

5-Is there a relationship between the levels of KAP of ionizing radiation among nurses with the following variables: age, gender, years of experience, the level of education, social status, work department, nationality?

SPECIFIC OBJECTIVES

1- To evaluate the knowledge score and level (based on the mean score) of ionizing radiation among nurses working at Jordanian government hospitals of the Ministry of Health in the central region of Jordan.

2-To evaluate the attitudes' score and level (based on the mean score) of ionizing radiation among nurses working at Jordanian government hospitals of the Ministry of Health in the central region of Jordan

3-To evaluate the practices' score and level (based on the mean score) of ionizing radiation among nurses working at Jordanian government hospitals of the Ministry of Health in the central region of Jordan

4- To investigate the relationship between KAP scores and Levels.

5-To study the relationship between the levels of KAP of ionizing radiation among nurses with the following variables: age, gender, years of experience, the level of education, social status, work department, nationality.

II. Literature Review

INTRODUCTION

Radiation is always present in our environment; however, mankind was not directly aware of its existence until the end of the 19th century, when flurries of scientific discoveries were made (Bushberg, 2002). Media exaggerated about the risks of radiation and highly stressed the importance of raising the level of awareness among people about the dangers of radiation in general. Consequently, various misconceptions, confusions, and erroneous beliefs appeared with regards to in-hospital radiation hazards. Studies documented that most people overestimate the risk of industrial radiation and underestimate the risk of medial radiation applications on the contrary (Mubeen, 2008).

Radiation is one of the most dangerous causes of pollution because its detection evades from human senses, and is only based on specific equipment. Atomic bombs during World War II, Chernobyl disaster, Fukushima accidents, and others resulted in anxiety and phobia among the public and health workers who were bound to radiation (Richard, 2016).

It is a matter of the fact that reducingthe exposure time, increasing the distance from the source, and shielding of the patients as well as the occupational workers proved to be of great importance because it has shown how itprotects the patients, personnel, and members of the public from the potential risks of radiation (Groveret al., 2002). These three radiation protection actions of "time-distance-shielding" are the triad of radiation protection. Radiation protection is a general term applied to the profession or science that is related to protecting man and the environment from radiation hazards. Nurses working in departments, units or wards where ionizing radiation is used should be knowledgeable about ionizing radiation and radiation protection practices. Thereby, this would enable them to give the patient the correct information and protect themselves, the patients and the general public from unnecessary radiation exposure.

Many researchers suggested that the risks of radiation can be reduced when nurses tend to use the important principle of ALARA; which in turn refers to As Low As Reasonably Achievable as well as various monitoring devices (Shere et al., 2002). ALARA is an important principle used in departments for the purposes of avoiding unnecessary radiation that is exposed to the human body. Furthermore, ALARA refers to receiving the maximum benefits of x-rays by using the minimum amount of radiation dose in order to eventually avoid its risks (Bushong, 1997).

2.1WHAT IS IONIZING RADIATION?

Ionizing radiation is the radiation that carries enough energy. Therefore, during the interaction with an atom, it can remove the electrons that are tightly bound from the orbit of the atom, causing the latter to become charged or ionized.

The main variation between ionizing and non - ionizing, is that ionizing radiation holds sufficient power to ionize the matter, injury, and denatures the proteins of the DNA,whereas the non -ionizing radiation is the radiation that does not hold sufficient power to ionize the matter, and cannot cause harm to humans. Nonetheless, the injury is generally limited to thermal injury,such as in burns. Furthermore, ionizing radiation is known to have the capacity to cause cancer, but non -ionizing radiation may cause cancer, but there is no obvious evidence to to assist this (IARC, 2015). Moreover, ionizing radiation is a short wave length, with great

frequency, and higher power. Despite the fact that the non- ionizing radiation can be found at long wavelengths, it might have a sufficient power to move the particles, causing them to fluctuate faster, such as favorable radiation (ultraviolet), cohesive andincohesive (laser), waves (APRENSA, 2016). This appears to be clear enough in microwave stove, where the radiation causes water molecules to move faster establishing heat (National Research Council, 1999).

2.2NUCLEAR ENERGY IN JORDAN
Jordan Atomic Energy Commission (JAEC) was established in place of the Jordan Nuclear Energy Commission. The main objective of the JAEC is to promote and develop a peaceful utilization of the atomic energy. Jordan's first nuclear power plant could be operational by 2025 if sufficient financing is secured. Moreover, under signing an agreement with Russia, Jordan plans to build a power plant with two nuclear reactors, each with the capacity of 1.000 megawatts (NWA, 2014) .

2.4KNOWLEDGE, ATTITUDES AND PRACTICES STUDIES TOWARDS IONIZING RADIATION
Various studies focused on radiation. In our literature review, no study was found describing Jordanian nurses' knowledge, attitudes or practices.

2.4.1 KNOWLEDGE, ATTITUDES, AND PRACTICES STUDIES REGARDING IONIZING RADIATION AMONG NURSES.

A cross-sectional descriptive study was done in Iran by (Dianati et al., 2014), among 44 nurses in one medical center (Intensive Care Unit) in medical, surgical, and the trauma ICUs of Shahid Be-heshti Hospital of Kashan, using a census-sampling method, a radiation protection knowledge questionnaire, and a check list, all of which were researcher- made. The questionnaire consisted of five questions related to nurses-age, gender; marital status, educational level, and ICU work experience. The response rate was 97.7%. Most of nurses in this study were females (90.90%) and the age of study participants ranged between (25-45) years. The range and the mean of participants' work experiences were (7.39 ±3.89) and 1-15 years, respectively. Accordingly, the overall knowledge was found insufficient among nurses, and the mean of participants' radiation protection knowledge was (4.77±1.38). In addition, the highest and the lowest scores were 2 and 8, respectively. In this study, the researcher found that 37 nurses 84% left the ICU and missed to monitor their patients during portable radiological examinations. The findings of this study might guide the nurses bout the correct behaviors they should have during portable radiological examinations. Some limitations might be noted while reading the results of the present study. This study was performed only in one- medical center and the study sample size was small. The study findings indicated that portable radiological examinations did not expose healthcare providers to high doses of ionizing radiation. Accordingly, clinical settings, which were designed and organized according to proper safety standards, can be considered safe and free from ionizing radiation during portable radiological examinations.

Lurtsi et al. (2016), a study that was done in Nigeria at three tertiary hospitals, Borno States; (Federal Neuropsychiatric, Specialist hospital, Maiduguri teaching hospital) sought to assess the level of knowledge, and the attitudes of nurses towards radiation protection in Maiduguri metropolis. A structured close-ended 14-items questionnaire was used to collect data. The questionnaire was divided into 2 sections. Section A consisted of the demographic data and section B consisted of the items related to the knowledge and attitudes towards radiation protection during radiography. Data were collected for a period of one month and analyzed by using a statistical package for social sciences. A descriptive design was used and the total sample size was 188. The study has found that female respondents were 98(52%), while male respondents were 90 (48%). Respondents with the age group of (26-30) years had the highest frequency, while those within the age group of 46, and above had the least frequency. Most of nurses 68 (36%) had diploma as their highest level of qualification and regarding the years of experience; 84 (44.7%) practiced for (0-5) years. It appeared clearly that the participants had good knowledge about ionizing radiation, and 60.4% knew the source benefits and the potential harm of ionizing radiation. Moreover, 79.9% agreed on the fact that using radiation in medical imaging could possibly cause harmful effects while 16.5% disagreed, while 4.3% did not know. The majority 79.3% of the nurses agreed that the x-ray used in medical imaging has more benefits than harm. The majority of the nurses, 42.6% wrongly assumed that objects in the room emit radiation after an x-ray exposure. Only 29.8% answered no while 27.1% did not know. The study also revealed that when the participants' years of practice increased, their attitudes towards radiation also became better. Consequently, this might be abated fear and misconceptions about ionizing radiation that may accrue over the length of years of practice. The study also found that the respondents had a positive knowledge and attitudes towards ionizing radiation during theatre and ward radiography.

2.4.2 KNOWLEDGE, ATTITUDES AND PRACTICES STUDIES REGARDING IONIZING RADIATION AMONG OTHER HEALTH CARE PROFESSIONALS.

In the Arab area, only couples of studies were conducted which in turn seemed to investigate ionizing knowledge attitudes and practices of ionizing radiation among health care professionals. A cross sectional study design was done in two largest referral hospitals at Palestine: Al-Makassed hospital (250 beds), and Ramallah governmental hospital (150 bed) among physicians. Both of them are fully accredited for postgraduate training in 6 medical specialists, including internal medicine, surgery, pediatrics, gynecology, and orthopedics by both the Jordanian and Palestinian Medical councils. Annually,these 2 hospitals together treat more than 150,000 people. There were 107 physicians working in AL-Makassed hospital and 60 physicians in Ramallah government hospital. A questionnaire was answered by 163 physicians who in turn revealed many gaps in knowledge (n=163). The response rate was high (97.6%) since the majority of the respondents were males (85.3%). Moreover, 43.6% were consultants, 47.9% were residents and the largest specialty groups of respondents were internal medicine specialists (19.6%), and surgeons (18.4%). Work experience of the respondents ranged from (5-20) years. (70%) of them reported that they had not attended a radiation protection course during their studies while 30% indicated that they received such a course at their workplaces. Only 8.1% of the respondents indicated correctly that there was in fact no dose limit defined for the patient, while the majority 81% indicated that they did not know. The result has shown that the majority of respondents (61.4%) indicated that they would do so in case of routine x-ray examinations, whereas 38.6% indicated that they would not. Only 13.5% selected the correct answer about the CT –scan, which was higher delivers radiation dose to patients. The majority 70% reported that they would reduce their requests for CT scans and 6.1% of the respondents were able to identify ALARA principles. The limitations of this study were related to the use of a self-reported questionnaire, making it difficult to validate the accuracy of the findings since some participants may exaggerate their knowledge. In addition, this study involved only the 2 largest referral hospitals in Palestine (Hamarsheh and Ahmead, 2012).

2.5 CONCLUSION

The literature has shown that most of the studies evidently focused on physicians and radiologists despite of the fact that nurses comprise the largest group of professional health care givers, and are considered to be an important source of information about health risks (AACN, 2011).

It is a matter of the fact that this study has shown several negative practices and attitudes among occupational health care providers and a lack of control over the applications of ionizing radiation. These practices and attitudes should be controlled and correctly redirected to protect caregivers and especially nurses from radiation risks.

Knowledge, attitudes, and practices of health care professionals about ionizing radiationwere evaluated in many studies from the perspective of different countries around the world.

Therefore, the significance of this study arises from the fact that it is the first study in Jordan that surveys nurses in order to assess their knowledge, attitudes, and practices about ionizing radiation and eventually redirect their attitudes to fulfill the premium quality of health care with the least possible health risks among health care givers.

III.   Material And Methods

3.1 STUDY DESIGN

This was a cross-sectional study that evaluated the knowledge, attitudes, and practices of a convient sample of nurses working at government hospitals of the Jordanian Ministry of Health in the central region in Jordan towards ionizing radiation, and the possible factors related to their level of knowledge, attitudes and practices.

3.2 SETTING OF THE STUDY.

The study was conducted at governmental hospitals of the Jordanian Ministry of Health in the central region. It comprised all nurses working in the hospitals regardless of their working status. Data collection was carried out over the period from 21st of March to the 21stof May, 2016.

3.3 TARGET POPULATION

The study targeted all nurses working at government hospitals of the Jordanian Ministry of Health in the central region (this included 7 government hospitals in the central region). Referring to the latest report of the Ministry of Health (2015), the number of nurses was 9339 in the government hospitals of the Ministry of Health. The Whole 2916 nurses in these hospitals were targeted to be contacted in order to participate in the study.

Inclusion criteria: nurses, who had a diploma, bachelor, master, or PHD degrees in the nursing field, both male and female. Their age was over 21 years old and they enjoyed having the license from the Jordanian Nurses and Midwives Council.

On the other hand, the study excluded those who did not have a diploma, bachelor, master, or PHD degree in the nursing field, and those who were less than 21 years old. Moreover, those who did not have the license from the Jordanian Nurses and Midwives Council had also been excluded from this study.

3.4 STUDY SAMPLE

The study utilized a convenient sample. A total of 7 hospitals were visited. All nurses working at those hospitals were approached in order to participate in the study (484). The final number of respondents was 472 nurses out 484.

The initial sample size estimation was carried out by using the following equation:

Sample size $=Z_{1-\alpha|2}2$ P (1-p) $\div D2$, the initial sample size was estimated 384. Added 100 to sample size for any sudden withdrawal from survey and to increase power of the survey =484.

Were:

$Z_{1-\alpha|2}$ was considered 1.96 as its standard for a P value of ≤ 0.05.

P was considered 0.5 since there is no available data from previous studies.

D The absolute error was considered .05 (Wayne, 2014).

3.5 INSTRUMENT OF THE STUDY, SCORING METHODS

The instrument of the study was a self–administered questionnaire which was in turn designed to measure knowledge, attitudes and practices of ionizing radiation among nurses. It was derived from previous studies in the recent literature conducted by (Luntsi et al., 2016), (Sampong et al., 2015), (Alotaibi et al., 2011), (Dianati et al., 2014), (Sin et al., 2013), (GZ Zhou et al.,2010), (Yunus et al., 2015), (Ayyasrah, 2003). After the covering letter that introduced the research goals (in Arabic and English), the questionnaire included four parts:

FIRST PART. General information about the person filling the questionnaire, and the department he\she was working in, age, gender, the educational level, and years of experience, nationality, and social status.

In addition, this part also included questions about the usual sources used to get information about ionizing radiation. Moreover, the respondents were asked if they attended some academic programs that discussed the topics related to ionizing radiation, and if nurses had efficient and sufficient information about ionizing radiation.

SECOND PART. Evaluation of the knowledge level about ionizing radiation (14 likert scale). The scores of the answers were as follow: for questions (11 to 18 and 21): each correct answer was given 1 point, while the wrong answer was given Zero (Circling more than one answer was considered to be a wrong answer). Moreover, questions (19, 20, and 22 to 24) were structured with a 5 response of agreements for knowledge questions. These responses were converted into 2 responses; agree or disagree. The correct answers were considered as "agree"for questions and given one point while a "disagree" answer was given zero (Circling more than one answer was considered a wrong answer). Thus, this gave a maximum possible score of 14 for the knowledge section.

THIRD PART: Evaluation of attitudes towards ionizing radiation (9 Likert scale). The attitudes part in the questionnaire was structured with a 5 response of agreements for the attitudes' questions. These responses were converted into 2 responses"agree" and "disagree". For questions (25, 26, 28 29): the correct answers of questions were considered to be "disagree" and were given one point while the "agree" answers were given zero. On the other hand, for questions (27, 30), the correct answers of the questions were considered to be "agree"and are given one point while the "disagree" answer was given zero. Questions (31 to 33) were structured with a 3 response. These responses were converted into 2 responses "Yes" or "No". The correct answers of questions were considered to be "Yes", and were given one point while "No" answers were given a zero point (Circling more than one answer was considered a wrong answer). Thereby, this resulted in a maximum possible score of 9 for the attitudes section.

FOURTH PART. Evaluation of practices towards ionizing radiation (7 likert - scale). The respondents were asked to rate their adopting of the specific behaviors.

Questions (36, 37, 40): Never (score 1 point), sometimes(score 0 points), always (score 0 points).

Questions (34, 35, 38, 39): Always (score 1 point), sometimes (score 0 points, never (score 0 points), giving a maximum possible score of 7 in the practices section.

The original questionnaire was constructed in Arabic. Content and face validity of the questionnaire was supported as its items were derived from previously conducted studies. Four experts in the nursing fields confirmed the validity in order to get the feedback that can in turn be taken into consideration for the purposes of improving the questionnaire of the study and add various modificationsin order to clarify the items as well as to translate the questionnaire into Arabic language and back translating the tools into English language after piloting.

The questionnaire is shown in Appendix 2.

3.6 Operational definitions

Knowledge is the information at which the individual would know what radiation protection policies and regulations are, the certain path physiological diseases resulting from radiation as well as the radiation protection measures. In this study, knowledge was measured according to the respondents' ability to correctly identify and respond to radiation protection policies and regulations, certain path physiological diseases resulting from radiation, as well as the radiation protection measures, too.

Overall knowledge: - It is the summary of all 14 questions. Each question contains 1 point for the correct answer and 0 for the wrong answer, so the total answers contain 14 points. The overall knowledge of the study participants was assessed by using the sum score of each outcome based on Bloom's cut-off point, while the average knowledge was calculated and multiplied with the percentage of the bloom level to obtain the scores which would be then classified into 3 levels as follow:

High-level knowledge: - Knowledge scores that fell above 5.47points (>70 %.).

Moderate level knowledge: -Knowledge scores that fell between 3.9- 5.47 points (50%-70%).

Low-level knowledge: - Knowledge scores below 3.9 points (less than 50%).

Attitude: Includes 9 items that assess the perception or the outlook regarding radiation preventive measures. The overall attitude of the study participants was assessed by using the sum score of each outcome based on Bloom's cut-off point, whereas the average attitudes were calculated and multiplied with the percentage of bloom level in order to obtain the scores that would be then classified into 2 levels (positive Attitude, negative attitude) according to Blooms- cut off point.

Positive Attitude - Attitude score that fell above 1.762 points (>70%).

Negative Attitude – Attitude score less than 1.258 points (less than 50%).

Practice: - is the overt behavior, habit that a person does, follows up or carries out in his/her daily work in prevention of complications regarding ionizing radiation. It was measured based on previous behavior, decisions and actions taken to prevent of the complications regarding ionizing radiation in daily work, 7 questions were used to assess the experience and action of the respondents. The overall practice of the study participants was assessed by using the sum score of each outcome based on Bloom's cut-off point, while the average practice was calculated and multiplied with the percentage of bloom level to obtain scores that would be then classified into 3 levels according to Blooms- cut off point.

Good practice: - Practice score that fell above 2.671 scores (>70%).

 Fair practice: - Practice score that fell between 1.91-2.671, (50% - 70%).

 Poor practice: -Practice score that fell below 1.91 (less than 50%).

3.7 PILOT STUDY

A pilot study was conducted for the purposes of an initial evaluation of the questionnaire in terms of the time that would be taken by the respondents to answer the questions. Clarity questions and any other notes would be given by the respondents. The pilot study included 25 nurses working at Al-Zarqa hospital. It was estimated that the questionnaire needs around 5-10 minutes to be filled, and some minor amendments were carried out.

3.8 DATA COLLECTION

        Data were collected by the researcher. In each hospital, the researcher has first visited the director of the hospital, and has shown him the consent form of the scientific research ethical committee issued by the Jordanian Ministry of Health, and then the researcher introduced herself to the nurses in the hospital and summarized the objectives of the study. Data collection was carried out over the period from 21st of March to 21st of May, 2016 from 10 a.m. to 6 p.m. in order to distribute the questionnaire among the nurses working in shift A and B. The questionnaires were distributed by the researcher to nurses to be filled.

         Some nurses filled the questionnaires and returned them on the spot, while other nurses asked to give them some time to fill it. In the latter case, the questionnaires were collected the following day. Moreover, the researcher left a number of questionnaires based on the number of the nurses working in shift C and asked those nurses working in shift B to deliver the questionnaire for the nurses working in shift C in order to be filled by them. In that case, the copies of answered questionnaires were collected the following day. At the end of each day, the data collected from the filled questionnaires in each hospital were coded and entered to the SPSS software version 17(Inc, 2008).

3.9 VARIABLES

1-Dependent variables

Knowledge of the respondents about ionizing radiation, attitudes and practices of respondents towards ionizing radiation.

2-Independent variables Socio demographic: -gender, nationality, educational level, social status, age, years of experiences, work department.

3.10 DATA ANALYSIS.

After completing data collection, data were entered to the statistical package SPSS 17(Inc., 2008), and were thoroughly analyzed.

Simple descriptive statistics (frequencies, mean, and standard deviations) were used to describe general information about the study subjects, the levels of knowledge, attitudes, practices, and sources of information on ionizing radiation.

In addition, chi-square, simple t- test, one-way analysis of variance (ANOVA) was used to determine whether there were significant differences in the levels of knowledge, attitudes and practices based on the general characteristics of the study respondents. Moreover, statistical significance was considered when p-value ≤ .05.

3.11 ETHICAL CONSIDERATIONS

After being approved by the Department of Family, community medicine, and the faculty of graduate studies at the University of Jordan, the study was submitted to the Scientific Research Ethical Committee at the Jordanian Ministry of Health to be approved before starting the data collection.

A statement of confidentiality was also included in the covering letter of the questionnaire; assuring that no disclosure for any of the information listed within the filled questionnaire will be declared.

IV. Background Characteristics Of The Study Sample

4.1.1 CHARACTERISTICS OF THE STUDY SAMPLE

Table 1: Distribution of nurses according to the hospital

The name of the governmental hospitals	N	%
Hamza	95	20.1
Al-totunji	50	10.6
Al-zarqa	70	14.8
Fasial	85	18
Al-baqaa	25	5.3
Al-basher	90	19.1
Al-salt	57	12.1
Total	472	100

Table 1. Reflectsed that the total number of respondents was 472; 95(20.1%) from Hamza, 50(10.6%) from Al-Totunji, 70(14.8%) from Al-Zarqa, 85(18%) from Fasial, 25(5.3%) from Al-baqaa, 90(19.1%) from Al-basher, 57(12.1%) from Al-salt . Total counts could be less than 472.

4.1.2 GENERAL CHARACTERISTICS OF THE STUDY SAMPLE

Table 2. Distribution of the study sample according to demographic characteristics.

Work department	N	%
Cardiac care unit	29	6.1
Intensive care unit	48	10.2
Cardiac catheterizing unit	1	.2
Emergency room	46	9.7
Operation room	354	7.4
Pediatric floor	47	10.0
Surgical floor	83	17.6
Other department	183	38.8
Total	472	100%
Gender		
Male	173	36.7
Female	299	63.3
Total	427	100
Age group		
21-26	81	17.2
27-32	217	46
33-38	100	21.2
39-44	48	10.2
45-50	23	4.9
51 and above	3	.6
	472	100
Social status		
Un-married	145	30.7
Married	327	69.3
Total	472	100

Years of experience		
Under one year	29	6.1
1-5 years	139	29.4
Over 5 years	304	64.4
Total	472	100
The educational level		
Diploma	102	21.6
Bachelor	351	74.4
Master	18	3.8
PHD	1	.2
Total	472	100
Nationality	N	%
Jordainan	465	98.5
Non- Jordanian	7	1.5
Total	472	100

From the Table 2, it is shown that the largest number of participants was from other departments, which contributed 138 participants (38.8% of the total sample). On the other hand, the smallest number of participants was found from the Cardiac Care Unit, and Cardiac Catheterizing Unit, which contributed only (1), (29) participants (0.2% and 6.1% of the total study sample); respectively.

Moreover, the gender variable divided the study population into (63.3%) females, and (36.7%) males. Around two thirds of nurses were females. Furthermore, table 2 indicated that study subjects in the age groups 27-32 years had the highest percentage (45.97%), while the age groups with the lowest percentage were above 51 years (.64%). The majority of participants were married (69.3%), and about one third of nurses were single (30.7%). The percentages of nurses with over 5 years, 1-5 years, and under one year experiences were 64.4, 29.4, and 6.1%; respectively. Also, the table showed 98.5% at study sample were Jordanian, and 1.5% were not Jordanian. Furthermore, the majority of nurses earned a bachelor's degree in nursing education (74.4%). In addition it showed that a small proportion of nurses got a diploma degree (21.6%); while few nurses got a master and a PHD degree (3.8%), (0.2%); respectively.

4.1.3 OTHER GENERAL CHARACTERISTICS REGARDING THE SOURCE THEY USUALLY USE TO GET INFORMATION ABOUT IONIZING RADIATION AND THEIR VIEW TOWARDS IONIZING RADIATION.

Table 3. The percentage and number of nurses about the source they usually use to get information about ionizing radiation.

Items	N	%
Newspapers	8	1.7
TV	18	3.8
Internet	68	14.4
Work department	252	53.4
All of above	126	26.7
Total	472	100

Table 3. Indicated that the most usually used source of information about ionizing radiation was the work department (53.4%), followed by all of above (26.7 %), internet (14.4%), Television (3.8%), and newspaper (1.7%).

Table 4. Percentages of nurses who believed they had a good knowledge of ionizing radiation

Items	N	%
Yes	124	26.3
No	348	73.7

Table 4, indicated that 73.7% of nurses who believed they did not have a good knowledge about ionizing radiation, compared to 26.3% of nurses who believed they had a good knowledge about ionizing radiation.

Table 5. Percentages of nurses who have attended programs of ionizing radiation during their study.

Items	N	%
No	454	96
Yes	18	3.8

Table 5 indicated that 96% of nurses did not attend programs of ionizing radiation during their study, compared to 3.8% of nurses who attended programs about ionizing radiation during their study.

4.2 KNOWLEDGE OF NURSES
4.2.1 KNOWLEDGE RELATED TO IONIZING RADIATION IN GENERAL.
Table 6. The percentage distribution of correct answers about knowledge questions related to ionizing radiation in general (n=472).

Questions	Number of correct answers	Percentages Of correct answers
-What is the best place for installing barriersto protect nurses against radiation? Nursing break room (Correct answer).	312	66.1%
-What is an apron made up of? Lead (Correct answer).	352	74.6%
-What is the radiation measurement Unit? All of above (Rad, Rem, Roentegen, Curie) (Correct answer)	55	11.7%
-What is the safest distance to be away from the source of radiation during exposure to rays? 12 feet (Correct answer)	193	40.9%
-What are the factors that play an important role in the protection from hazardous radiation? All of the above (time, distance from source, shielding) (Correct answer).	369	78.2%
-Which of the following radiographic examination lead to the most exposure to ionizing radiation? CT scanning (Correct answer).	301	63.8%
-Have you heard before about the radiological safety program ALARA and its principles? Yes No	28 444	5.9% 94.1%
-Do rays reflect from the walls of the rooms? Yes No	281 191	59.5% 40.5%
-How much is the amount of radiation received as a result of exposure to CT scan equivalent to how many multiples of x-rays radiation? 300 multiples of x-rays radiation (Correct answer).	83	17.6%
-Have you heard about radiation leakage? Yes No	303 169	64.2% 35.8%

As shown in Table 6, the question that asks about the factors that play an important role in being protected from hazardous radiation had the highest percentage of correct answers among all other questions (answered correctly by 78.2% of nurses in the sample).
On the other hand, the question that had the lowest percentage of correct answers was basically about radiation measurement units when reporting (answered correctly by only 11.7% of study participants).

4.2.2 KNOWLEDGE RELATED TO IONIZING RADIATION HAZARDS.
Table 7. The percentage distribution of correct answers to knowledge questions related to ionizing radiation hazards (n=472).

Questions	Number of answers	Percentage of answers
-Does radiation increase the risk of cancer? Agree (correct answer) disagree	423 49	89.6% 10.4%
-Does radiation increase the risk of infertility? Agree (Correct answer) Disagree	345 127	73.1% 26.8%
-Does radiation increase the risk of congenital malformations? Agree (Correct answer) Disagree	345 127	73.1% 26.8%
Is radiation dangerous? Agree (Correct answer) Disagree	415 57	87.9% 12.1%

The correct answers to those questions which were related to knowledge ionizing radiation hazards were presented in table 7.With regards to knowledge about ionizing radiation in Jordan, it seemed clear that (89.6%) of nurses reported that they agreed that ionizing radiation increases the risk of cancer.

In addition, a very low percentage of nurses (10.4%) reported that they disagreed that ionizing radiation increases the risk of cancer.

Moreover, (73.1%) of nurses agreed that radiation increases the risk of infertility, and the lowest percentage of nurses (26.8%) disagreed that radiation increases the risk of infertility. Furthermore, (73.1%) of nurses reported that they agreed that radiation increases the risk of congenital malformations, while (26.8%) of nurses reported that they disagreed that radiation increases the risk of congenital malformation.

In addition, (87.9%) of nurses agreed that radiation is dangerous, and only (12.1%) of nurses disagreed that radiation is dangerous.

4.3 ATTITUDES OF NURSES:
Response to questions related to attitudes towards ionizing radiation in general are presented in table 8.

Table 8.The percentage distribution of nurses according to attitudes 'questions (n=472) of ionizing radiation.

Attitudes questions:	N	%
25- In your own opinion, a radiological technician asked a certified nurse (Ahmed) to hold the x-ray radiograph during exposure to radiation. If you were Ahmed, would you agree to do the same?		
● Agree	342	72.4%
● Disagree (Correct answer)	130	27.5%
26- In your own opinion, do you agree about asking patients to hold the radiograph during exposure to radiation?	N	%
● Agree	333	70.5%
● Disagree (Correct answer)	139	29.4%
27-In your own opinion, Do you agree that there should be an adherence to the radiation protection idea in the future?	N	%
● Agree(Correct answer)	442	93.6%
● Disagree	30	6.4%
28- A radiological technician refused to have a CT- scan for a pregnant woman. If you were in the same situation, would you do the same as the radiological technician?	N	%
● Agree	359	76%
● Disagree (Correct answer)	113	23.9%
29- If children are allowed to enter the Cardiac Catheter Unit by nurses for special causes because of the large area of the Unit. If you dealt with such a case, would you agree to do the same?	N	%
● Agree	359	93.6%
● Disagree (Correct answer)	30	6.4%

Note, scoring questions (25.26.28.29) answering, "agree"is considered as a negative response and hence analyzed accordingly.

Most of nurses (72.7%) stated that they agreed on the idea of holding the x-ray radiograph during radiation exposure. However, (27.5%) of nurses disagreed to hold the x-ray radiograph during radiation exposure.

In addition, (70.5%) of nurses noted that they agreed on asking patients to hold the radiograph during radiation exposure, while (29.4%) of nurses disagreed on asking patients to hold the radiograph during radiation exposure.

Furthermore, most of nurses (93.6%) have shown that they agreed with the adherence to protection radiation idea in the future, while (6.4%) of nurses disagreed on reporting their adherence to protection radiation idea in the future.

More than two third (76%) of nurses agreed on refusing to have a CT scanning for pregnant patients from technicians, while 23.9% of nurses disagreed about it.

More than two third of nurses (77.7%) agreed that children should be allowed to enter the catheterizing unit for special causes, while (22.2%) of nurses disagreed about it.

Most of nurses (93.4%) reported that they never dealt with patients injected with radioactive radiation, only (6.6%) of nurses dealt with patients injected with radioactive radiation. Most of nurses (49.9%) reported that they are always exposed to x-rays themselves. (50.7%) also said that they are never exposed to x-ray by themselves. In addition, (12.1%) said that they always tend to accompany the patients to the radiology department, and (87.8%) said that they have never accompanied patients to the radiology department. The highest percentage of nurses (93.8%) agreed that much more concern should be paid to an exposure to radiation, while the lowest percentage of nurses (6.1%) disagreed that, there should be much more attention to the topic related to exposure to radiation.

4.4 PRACTICES OF NURSES
Responses to questions related to practices of nurses are presented in table 9.

Table 9.The percentage distribution of nurses' practices towards ionizing radiation

Question	N	%
34- Based upon your daily practice at work, have you ever received education or training regarding protection ways against ionizing radiation?		
Always	46	9.7%
Some times	171	36.2%
Never	255	54.0%
36- Based upon your daily practice, do you remain in your unit during radiological exposure?		
Always	170	36%
Some times	207	43.9%
Never	95	20.1%
37- During your daily practice, do you stand behind a radiological technician during radiological exposure?	N	%
Always	168	35.6%
Some times	209	44.3%
Never	95	20.1%
38- Based upon your daily practice, do you usually wear a lead protective apron during exposure to radiation?	N	%
Always	143	30.3%
To some extent	187	39.6%
Never	142	30.1
39- Based upon your daily practice, do you make sure that the department is free from visitors during exposure to radiation?	N	%
Always	179	37.9%
Sometimes	174	36.9%
Never	119	25.2%
40-Based upon your daily practice, does a pregnant nurse accompany patients to the radiology department at your work?		
Always	54	11.4%
Sometimes	119	25.%

Never	299	63.3%
35– Based upon your daily practice, do you put apron on abdomen for pregnant patients during radiation exposure ?	N	%
Always	210	44.5%
Some times	133	28.2%
Never	129	27.3%

Note, scoring questions 36, 37, 40, answering 'always' is considered as a negative response and hence analyzed accordingly.

With regards to the practices of nurses towards ionizing radiation, the majority of nurses (63.3%) said that pregnant nurses have never accompanied the patients to the radiology department. One-third (30.1%) said that they have never worn a lead apron during radiological examinations. Moreover, most of nurses (54.0%) reported that they have never received education or training about protection ways against ionizing radiation.

Only (27.3%) said that they have never put apron on abdomen for a a pregnant patient during radiological examinations, while only (20.1%) reported that they have never stood behind the radiologist during radiological examinations. However, only (20.1%) reported that they have never remained in the unit during radiological examinations and only (25.2%) said that they have never observed their department during exposure.

4.5 KNOWLEDGE, ATTITUDES AND PRACTICES' SCORES.
Table 10. presents the overall knowledge, attitudes, and practices scoring results.
Table 10. Overall knowledge, attitudes, and practices score.

Variables	Range of possible scores	Minimum score	Maximum Score	Mean score	SD
Overall knowledge score	0-14	3.9	5.47	7.8178	1.59373
Overall attitudes score	0-9	1.258	1.762	2.5169	1.34485
Overall practices score	0-7	1.91	2.671	3.8157	1.49661

SD: Standard Deviation.
The minimum score obtained for knowledge was (3.9), and the maximum was (5.47). A high mean was obtained (7.8178) with a standard deviation of (1.59373).
The minimum score obtained for attitudes was (1.258), and the maximum was (1.762). The mean attitude score for the entire sample was (2.5169) with a standard deviation of (1.34485).
The minimum score obtained for practices was (1.91) and the maximum was (2.671). The mean practice score for the entire sample was (3.8157) with a standard deviation (1.49661).

4.6 KNOWLEDGE, ATTITUDES AND PRACTICES' SCORES ACCORDING TO THE CHARACTERISTICS OF THE NURSES.
4.6.1 KNOWLEDGE SCORES ACCORDING TO THE CHARACTERISTICS OF THE NURSES.
Table 12 shows the differences in knowledge scores of nurses based on gender, social status, age group, work department, years of experience, nationality, and educational levels.

Table 12. The distribution of knowledge scores according to selected characteristics of nurses.

Gender	Mean Score (SD)*		P –value
Male	7.7861	1.61585	.743
Female	7.8361	1.58323	
Years of experience			
Under 1 year	7.172	1.33	.048
1-5 years	7.7482	1.71	
Over 5 years	7.911	1.544	
Educational levels			
Diplomat	7.9510	1.655	.213
Bachelor	7.774	1.586	

	Mean	SD	
Master	8.055	1.258	
PHD	5	.	
Social status			.469
Un- married	7.7379	1.56800	
Married	7.8532	1.60612	
Nationality			.374
Jordanian	7.825	1.59666	
Non Jordanian	7.2857	1.38013	
Age group	**Mean**	**SD**	**P- value**
21-26	7.58	1.634	.080
27-32	7.83	1.508	
33-38	7.760	1.753	
39-44	8.125	1.524	
45-50	8.304	1.520	
Over 50	6	1	
Work department	Mean	SD	P -value
Cardiac Care unit	8.069	1.624	0.359
Intensive Care unit	7.750	1.376	
Cardiac Catheterizing unit	7	0	
Emergency department	7.543	1.559	
Operation room	8.114	1.529	
Pediatric floor	8.191	1.42399	
Surgical floor	7.8916	1.6288	
Other departments	7.6831	1.6700	

** One- way analysis of variance (ANOVA) and simple independent t- tests were applied.

Females obtained a higher mean knowledge score (7.8361) compared to males (7.7861). However, the difference did not reach a statistically-significant level (p value =.743).

There was not statistically-significant differences in knowledge scores between different age groups (p=.080), with the category of 45-50 years having the highest score (8.304). On the other hand, the age group over 50 years had the lowest score (6).

There was not a statistically-significant a difference in knowledge scores between nationality (p=.374), obtained different means; Jordanians (7.8258) obtained the highest mean compared to non-Jordanians who obtained the lowest mean (7.2857).

With regards to the educational level, nurses from various educational levels obtained different means.The highest mean was obtained by the master level (8.055), while the lowest was obtained by the PHD level (5).The differences of scores between different educational levels did not reach astatistically-significant level, (p=.213).

The mean knowledge scores were statistically-significant among nurses with different years of experience (p=.048), ranging from (7.911) for nurses having Over 5 years of experience to (7. 172) having less than one year of experience.

Married nurses had a higher knowledge mean score (7.85) as compared to un-married nurses (7.7379), but the difference was not statistically significant, (p=.469).

The overall knowledge score was not statistically-significant different according to work department (p=.359). The highest knowledge mean score was found in pediatric floor which scored a mean of (Score-= 8.191, SD= 1.423). The lowest knowledge score was obtained by nurses from the Cardiac Catheterizing Unit (Score=7).

4.6.2 ATTITUDES' SCORES ACCORDING TO THE CHARACTERISTICS OF NURSES.
Tables 13. Shows the differences in the attitudes' scores of nurses based on gender, social status, age group, work department, years of experience, nationality, and educational levels
Table 13. The distribution of Attitudes' scores according to selected characteristics of nurses

Gender	Mean Score (SD)*		P –value **
Male	2.5318	1.34483	.856
Female	2.5084	1.34704	
Years of experience			.427

Under 1 year	2.5172	1.2711	
1-5 years	2.6403	1.4396	
Over 5 years	2.4605	1.3069	
Educational levels			.818
Diploma	2.5784	1.25419	
Bachelor	2.4872	1.37497	
Master	2.7222	1.31978	
PHD	3	.	
Social status			.206
un-married	2.6345	1.38350	
Married	2.4648	1.32617	
Nationality			.647
Jordanian	2.5204	1.34873	
Non Jordanian	2.2857	1.11270	
Age group			.822
21-26	2.5802	1.33102	
27-32	2.5576	1.40028	
33-38	2.48	1.15014	
39-44	2.3750	1.42359	
45- 50	2.4783	1.59173	
Over 50	1.6667	.57735	
Work department	Mean	SD	p- value
Cardiac Care unit	3	1.772	.062
Intensive Care unit	2.7292	1.23322	
Cardiac Catheterizing unit	4.00	0	
Emergency department	2.7174	1.2765	
Operation room	2.1143	1.27651	
Pediatric floor	2.5319	1.38079	
Surgical floor	2.6145	1.41276	
Other department	2.3552	1.28797	

SD: Standard Deviation.

** One- way analysis of variance (ANOVA), and independent t- tests were applied.

Males recorded higher attitudes scores (scores =2.5318, SD= 1.34483) than females (scores =2.5084, SD=.1.34704), with no statistically-significant difference (p=.856).

Differences in mean attitudes scores varied based on age group with no statistically significance, (p=.822). Ranging from (score =2.5802, SD=1.33102) for nurses in the age group 21-26 years to (scores =1.6667, SD=.57735) for nurses in the age group over 50 years.

Mean attitudes scores did not vary significantly among nurses with different educational levels, (p=.818). Ranging from (scores =3) for nurses having a PHD degree to (scores =2.4872, SD=1.37497) for nurses having bachelor degree.

The differences between mean attitudes scores did not vary significantly between nurses having different years of experience, (p=.427). Ranging from (Scores =2.6403, SD=1.4396) for nurses having 1-5 years of experience to (Scores =2.4605, SD=1.3069) for nurses having over 5 years of experience.

Married nurses obtained lower scores (Scores =2.4648, SD=1.32617), than un-married nurses (Scores=2.6345 SD=1.38350). The difference approached, but did not reach a significant level (p=.206).

Jordanian nurses obtained higher attitudes' scores (Scores =2.5204, SD=1.34873), than non-Jordanian nurses (Scores=2.2857, SD=1.11270). Nonetheless, the difference did not reach a significant level, (p=.647).

Overall attitude score was not statistically significant different according to work department (p=.062). Nurses working at Cardiac Catheterizing Unit obtained the highest attitudes' score (Score= 4), while participants from the operation room obtained the lowest score (Score =2.1143, SD=1.276).

4.6.3 PRACTICES SCORES' ACCORDING TO THE CHARACTERISTICS OF NURSES.
Table 14 shows the differences in practice scores of nurses based on gender, social status, age group, work department, years of experience, nationality, and educational levels.

Table14.The distribution of practices' scores according to selected characteristics of nurses

Gender	Mean Score (SD)*		P –value **
Male	3.9075	1.41938	.311
Female	3.7625	1.53935	
Years of experience			.905
Under 1 year	3.7931	1.58968	
1-5 years	3.8633	1.58892	
Over 5 years	3.7961	1.44806	
Educational levels			.569
Diploma	3.6863	1.58571	
Bachelor	3.8689	1.46187	
Master	3.5000	1.68907	
PHD	4	.	
Social status			.238
Un-married	3.9379	1.50564	
Married	3.7615	1.49169	
Nationality			.857
Jordanian	3.8172	1.50535	
Non Jordanian	3.7143	.75593	
Age group			.013
21-26	3.6420	1.50257	
27-32	3.8479	1.47193	
33-38	4.0900	1.51821	
39-44	3.2708	1.44015	
45-50	4.2174	1.41282	
Over 50	2.6667	1.52753	
Work department	Mean	SD	P -value
Cardiac Care unit	4.2069	1.44863	0.842
Intensive Care unit	3.5833	1.33422	
Cardiac Catheterizing unit	4	0	
Emergency department	3.7609	1.47851	
Operation room	3.7429	1.24482	
Pediatric floor	3.8936	1.41781	
Surgical floor	3.8434	1.53402	
Other department	3.8087	1.60409	

*SD: Standard Deviation.
** One -way analysis of variance (ANOVA) and simple independent t –tests were applied.
Although males (Scores =2.64, SD=1.53) scored higher than females (Scores =2.54, SD=1.56) in terms of practices; the difference did not reach a statistically-significant level, (p=.856).

The mean practices' scores did not vary significantly among different age groups, (P = .013). Nurses in the age groups (45-50) scored the highest (Score=4.2174, SD=1.41282). Moreover, nurses from various educational levels did not vary significantly in their practices' scores (p=.569), with the highest mean practice scores was that of the PHD level (Score = 4).

Nurses with various years of experience did not vary significantly in their practices' scores (p=.905). Ranging from (Scores=3.8633, SD=1.58892) for nurses having between 1- 5 years of experience.

Jordanian nurses scored higher (Scores=3.8172, SD=.1.50535) in terms of practice than non-Jordanian nurses (Score=3.7143, SD=.75593). However, the difference did not reach a statistically-significant level (p value=.857). The mean practices' scores varied significantly among un-married nurses who scored (Scores =3.9379, SD=1.50564) than married nurses who scored (Scores=3.7615, SD=1.49169). Nonetheless, the differences did not reach a statistically-significant level (p value =.238).

Differences in the mean practices' scores among nurses working in various work departments did not reach a significant level, (p=.842). The highest practice mean score was found in the Cardiac Care Units, which scored a mean of 4.2069, (SD=1.44863). The lowest practice score was obtained by nurses from the Intensive Care Unit (Score =3.5833, SD=1.33422).

Table 15. Levels of knowledge, attitudes, and practices according to Blooms classification.

Variables	Poor		Average		Good	
	N	%	N	%	N	%
knowledge	1	.2	38	8.1%	433	91.7%
attitudes	106	22.5%	-	-	366	77.5%
practices	37	7.8%	54	11.4%	381	80.7%

Table 15. Presents the distribution of study participants based on their level of knowledge, attitudes, and practices. It is shown that most of nurses had an excellent level of knowledge, good attitudes, and good practices regarding ionizing radiation (91.7%, 77.5%, 80.7%) respectively.

Table 16. Chi-square test result for the association between knowledge towards ionizing radiation and Socio demographic characteristics of nurses.

Work department		knowledge bloom				P value X^2
		less than 50% low	50-70% Average	more than 70% Good	Total	
Cardiac care unit	N	-	3	26	26	
	%	-	10.3%	89.7%	100%	
Intensive care unit	N	-	1	47	48	
	%	-	2.1%	97.9%	100%	
catheterizing unit	N	-	-	1	1	
	%	-	-	100%	100%	
Emergency Department	N	-	5	41	46	
	%	-	10.9%	89.1%	100%	
Operation Room	N	-	3	32	35	**0.896**
	%	-	8.6%	91.4%	100%	
Pediatric floor	N	-	6	77	47	
	%	-	7.2 %	92.8%	100%	
Surgical floor	N	-	2	95	83	
	%	-	4.3%	95.7%	100%	
Other department	N	1	18	164	183	
	%	.5%	9.8%	89.6%	100%	
Gender						
Male	N	1	16	156	173	
	%	0.6%	9.2%	90.2 %	100%	0.278
Female	N	-	22	38	299	
	%	-	7.4%	8.1%	100%	
Years of experience						
Under 1 year	N	-	3	26	29	
	%	-	10.3%	89.7%	100%	
1-5 years	N	1	15	123	139	
	%	0.7%	10.8%	88.5%	100 %	**0.294**
Over 5 years	N	-	20	284	304	
	%	-	6.6%	93.4%	100 %	
The educational level						
Diploma	N	-	7	95	102	**0.420**
	%	-	6.9%	93.1%	100%	

Bachelor	N	1	29	321	351	
	%	.3%	8.3%	91.5%	100%	
Master	N	-	1	17	18	
	%	-	5.6%	94.4%	100%	
PHD	N	-	1	-	1	
	%	-	100%	-	100%	
Social Status						
Un-married	N	1	10	134	145	
	%	0.7%	6.9%	92.4%	100%	**0.256**
Married	N	-	28	299	327	
	%	-	8.6%	91.4%	100%	
Nationality						
Jordanian	N	1	-	427	465	
	%	.2%	-	91.8%	100%	**0.845**
Non-Jordanian	N	-	1	6	7	
	%	-	14.3%	85.7%	100%	
Age Group						
21-26	N	-	9	72	81	
	%	-	11.1%	88.9%	100%	
27-32	N	-	14	203	217	
	%	-	6.5%	93.5%	100%	
33-38	N	1	10	89	100	
	%	1%	10%	89%	100%	**0.62**
39-44	N	-	2	46	48	
	%	-	4.2%	95.8%	100%	
45-50	N	-	2	21	23	
	%	-	8.7%	91.3%	100%	
Over 50	N	-	1	2	3	
	%	-	33.3%	66.7%	100%	

Table 16. It was noticed that there was no significant differences among the participants according to the gender, age group, social status, work department, nationality, years of experience, the educational level, and the level of knowledge.

Furthermore, most of female nurses (92.6%) were within the knowledge level (>70%). Most of intensive care unit nurses (97.9%) were within the knowledge level (>70%). In addition, (93.4%) of nurses within an experience of over 5 years had the knowledge level (>70%).

In addition, most of master nurses (94.4%) were within the knowledge level (>70%) and(92.4%) of un-married nurses were within the knowledge level (>70%).

Finally, most of Jordanian nurses (91.4%) were within the knowledge level (>70%), and (95.8%) of nurses within the age group (39-44) years had the knowledge level (>70%).

Table 17. Chi-square test result for the association between attitudes towards ionizing radiation and Socio demographic characteristics of nurses.

Work department		Attitudes bloom				P value X^2
		less than 50% low	50-70% Average	more than 70% Good	Total	
Cardiac care unit	**N**	7	-	22	29	
	%	24.1%	-	75.9%	100%	
Intensive care unit	**N**	5	-	43	48	
	%	10.4%	-	89.6%	100%	
catheterizing unit	**N**	-	-	1	1	
	%	-	-	100%	100%	
Emergency Department	**N**	7	-	39	46	
	%	15.2%	-	84.8%	100%	
Operation Room	**N**	8	-	27	35	
	%	22.9%		77.1%	100%	**0.214**
Pediatric floor	**N**	13	-	34	47	
	%	27.7%	-	72.3%	100%	
Surgical floor	**N**	17	-	66	83	
	%	20.5%	-	79.5%	100%	
Other department	**N**	49	-	134	183	
	%	26.8%	-	73.2%	100%	
Gender						
Male	N	37	-	136	173	
	%	21.4%	-	78.6%	100%	**0.671**
Female	N	69	-	230	299	
	%	23.1%	-	76.9%	100%	
Years of experience						

Under 1 year	N	5			24	29	
	%	17.2%	-		82.8%	100%	
1-5 years	N	29			110	139	
	%	20.9%	-		79.1%	100%	**0.623**
Over 5 years	N	72			232	304	
	%	23.7%	-		76.3%	100%	

The educational level							
Diploma	N	22			80	102	
	%	21.6%	-		78.4%	100%	
Bachelor	N	80			271	351	
	%	22.8%	-		77.2%	100%	
Master	N	4			14	18	**0.901**
	%	22.2%	-		77.8%	100%	
PHD	N	-	-		1	1	
	%	-	-		100%	100%	

Social Status							
Un-married	N	23			83	145	
	%	15.9%	-		25.4%	100%	
Married	N	122			244	327	**0.019**
	%	84.1%	-		74.6%	100%	

Nationality							
Jordanian	N	104			361	465	
	%	22.4%	-		77.6%	100%	
Non-Jordanian	N	2			5	7	**0.704**
	%	28.6%	-		71.4%	100%	

Age Group							
21-26	N	16			65	81	
	%	19.8%	-		80.2%	100%	
27-32	N	49			168	217	
	%	22.6%	-		77.4%	100%	
33-38	N	21			79	100	
	%	21.0%	-		79%	100%	**0.925**
39-44	N	13			35	48	
	%	27.1%	-		72.9%	100%	
45-50	N	6			17	23	
	%	26.1%	-		73.9%	100%	
Over 50	N	1			2	3	
	%	33.3%	-		66.7%	100%	

Table 17. has shown that there was a significant difference among the participants according to the social status (p=.019) and the level of attitudes. Most of married nurses (74.6%) were within the attitudes level (>70), while only (15.9 %) of single nurses were within the attitudes level (less than 50 %).

Most of intensive care unit nurses (89.6%) were within the attitudes level (>70%), whereas most of male nurses were within the attitudes level (>70%). Furthermore, (82.8%) of nurses within an experience of less than one year were with the attitudes level (>70%).

More than two third of bachelors nurses (77.2%) were within the attitudes level (>70%). Furthermore, (77.6.%) of Jordanian nurses were within the attitudes level (>70%) and (80.2%) of nurses within the age group (21-26) years were with the attitudes level (>70%).

Table 18. Chi-square test result for the association between practices towards ionizing radiation and Socio demographic characteristics of nurses.

Work department		Practices bloom				P value X^2
		less than 50% low	50-70% Average	more than 70% Good	Total	
Cardiac care unit	N	-	5	24	29	
	%	-	17.2%	82.8%	100%	
Intensive care unit	N	3	6	39	48	
	%	6.2%	12.5%	81.2%	100%	
catheterizing unit	N	-	-	1	1	
	%	-	-	100%	100%	**0.546**
Emergency Department	N	4.3%	6	38	46	
	%	15.2%	13%	82.6%	100%	
Operation Room	N	2	3	30	35	
	%	5.7%	8.6%	85.7%	100%	
Surgical floor	N	4	2	41	47	
	%	8.5%	4.3%	87.2%	100%	

Pediatric floor	N	8	8	67	83	
	%	9.6%	9.6%	80.7%	100%	
Other department	N	18	24	141	183	
	%	9.8%	13.1%	77%	100%	
Gender						
Male	N	9	20	144	173	**0.247**
	%	5.2%	11.6%	83.2%	100%	
Female	N	28	34	237	299	
	%	9.4%	1.4%	79.3%	100%	
Years of experience						
Under 1 year	N	3	4	22	29	
	%	10.3%	13.8%	75.9%	100%	
1-5 years	N	13	15	110	139	**0.869**
	%	9.4%	10.8%	79.9%	100%	
Over 5 years	N	21	35	248	304	
	%	6.9%	11.5	81.6%	100%	
The educational level						
Diploma	N	12	12	78	102	
	%	11.8%	11.8%	76.5%	100%	
Bachelor	N	23	38	290	351	
	%	6.6%	10.8%	82.6%	100%	**0.472**
Master	N	2	4	12	18	
	%	11.1%	22.2%	66.7%	100%	
PHD	N	-	-	1	1	
	%	-	-	100%	100%	
Social Status						
Un-married	N	11	12	122	145	
	%	7.6%	8.3%	84.1%%	100%	
Married	N	26	42	259	327	**0.322**
	%	8.0%	12.8%	79.2%	100%	
Nationality						
Jordanian	N	37	54	374	465	
	%	8%	11.6%	80.4%	100%	
Non-Jordanian	N	-	-	7	7	**0.221**
	%	-	-	100%%	100%	
Age Group						
21-26	N	7	13	61	81	
	%	8.6%	16%	75.3%	100%	
27-32	N	18	20	179	217	
	%	8.3%	9.2%	82.5%	100%	
33-38	N	5	9	86	100	
	%	5%	9%	86%	100%	
39-44	N	5	11	32	48	**0.132**
	%	10.4%	22.9%	66.7%	100%	
45-50	N	1	1	21	23	
	%	4.3%	4.3%	91.3%	100%	
Over 50	N	1		2	3	
	%	33.3%	-	66.7%	100%	

Table 18. It is noticed that there was no significant difference among the participants according to the gender, age group, social status, work department, nationality, years of experience, the educational level, and the level of practices.

More than two third (77%) of other department nurses were within the practices level (>70%). Moreover, more than two third male nurses (83.2%) were within the practices level (>70%) and(81.6%) of nurses within an experience of over than 5 years were within the practices level (>70%).

Most of bachelor nurses (82.6%) were within the practices level (>70%), while (84.1%) of un-marreied nurses were within the practices level (>70%).

Most of Jordanian nurses (80.4%) were within the practices level (>70%), while (91.3%) of nurses within the age group (45-50) years were within the practices level (>70%).

V.   Discussion

This chapter will discuss the findings of the current study and will also compare the obtained results with what was found in a number of studies around the world.

This chapter will also explain the gaps between the findings of this study and other studies as well.

5.1 GENERAL CHARACTERISTICS OF THE STUDY POPULATION.

Respondents from Hamza hospital had the highest percentage of participation than those from other government hospitals. However, the results did not compare the responses from other government hospitals because there was no statistically-significant differences in the responses based on the hospitals themselves. This was simply because they are all government hospitals. Accordingly, nurses from the seven hospitals were considered as one population when reporting the results.

The highest percentages of nurses in the study were obtained from other departments (contributed 38% of the study sample). On the other hand, the lowest number of participants was found in the Cardiac Catheterizing Units, which contributed only (6.1%). This was mainly because of the fact that other departments, such as (labor, medical, fluoroscopy, maternity) were larger and had a higher number of nurses than other departments. This finding was evidently inconsistent with Ayyasraha,a cross-sectional study in New York among 219 nurses, at which they observed that (10%) of nurses worked in other departments. The possible explanation for this discrepancy could be due to the difference in the sample size, where that many of the nurses were working at the study sites at the time when the study was conducted. A small percentage of nurses in this study tended to usually use media as a main source to get information about ionizing radiation and this was lower than the percentage found in Ayyasrah study, at which most of nurses usually used the media to get information about ionizing radiation. The fact that work department wasconsidered to be the most resourse used to get information about ionizing radiation could be due to the flexible accessibility to the information during their work. Moreover, media might not be allowed in their work (Ayyasrah, 2003).

In this study, more than two thirds of nurses were females and the majority of nurses earned a bachelor's degree in nursing education. This was similar to Sampong et al study; a quantitative, descriptive cross-sectional study which was conducted among 43 nurses in Korle-Bu Teaching hospital in Ghana. This study found that the majority of the respondents were females. 88.4% reported some inconsistent findings in their study about the level of education and over 65% of the population had diploma qualifications. Consequently, the possible explanation for the higher percentage among females than males regarding KAP of ionizing radiation among nurses could be because females in this study were more reportable than males. Furthermore, most of the nurses in the central region of Jordan tend to obtain a bachelor's degree in nursing simply because the educational level in Jordan regarding nursing is in a continuous progress and there was an increase in the Jordanian universities that grant the bachelor's degree in nursing for students(Samponge et al., 2015).

The highest percentage of nurses in this study was within the age group 27-32 years, while the lowest percentage was over 50 years. Moreover, most nurses have a nursing experience of over 5 years and the majority of them were married 69.28%. In addition, across-sectional study was conducted at Putrajaya in Malaysia among 27 nuclear medicine nurses at which there was an inconsistent finding regarding the years of experience, and the age group of nurses. InYunus et al study, it was found that 92.6% of respondents were females, while 7.4% were males. Furthermore, only 7.4% of nurses were 30-39 years old and 85.2% were of diploma holders. Therefore, this group of nurses was identified to have a very limited working experience on radiation (0-2 years) (Yunus et al., 2015).

A descriptive cross-sectional study was conducted in three tertiary hospitals, the University of Maiduguri teaching hospital, Federal Neuro-psychiatric hospital, and State specialist hospital in Nigeria,which in turn indicated that the highest percentage of nurses was among the age group 25-30 years. Moreover, 44.7% practiced for 0-5 years and only one nurse 1% had the PhD, while 2% had a master degree and 30 % obtained the bachelor's degree. Thereby, most of nurses 36% had the diploma as their highest level of qualifications.

Similarly, adescriptive study was conducted among 137 nurses working in the operation room in Busan, Korea. In this study, 56.6 % of nurses had a nursing experience with over 5 years. However; inconsistently with the findings, about 62.8% of the nurses were un-married and this might be due to the differences in the cultural beliefs. Thereby,   a possible explanation for this might be the willingness of young nurses in Jordan to work in governmental hospitals in order to get good income or because nurses in Jordan prefer to work in government hospitals for the purposes of enjoying the advantages of job security compared to private hospitals at which nurses receive less income and have much more load of work, which in turn meant that nurses would enjoy the advantages of having more secure job for longer time in government hospitals compared to private ones (Gum et al., 2013).

5.2 COMPARING THE FINDINGS OF OUR STUDY WITH THOSE OF OTHER STUDIES.

The study has found that the overall mean of knowledge score was (7.8178±1.59373) and that most of nurses (91.7%) had a good level knowledge. Furthermore, the study has shown that the overall mean of attitudes scores was (2.5169±1.34485). Moreover, (77.5%) of subjects had a good level of attitudes and the overall mean of practices' score of nurses was (3.8157±1.548), and (80.7%) of the nurses had a good level of practices.

This percentage was higher than that of (Alotaibi, 2011); a cross sectional survey in governmental general and private hospitals and centers in Kuwait.Among 26 non-Kuwaiti female nurses, the overall mean of radiation awareness was (1.19±.65). The possible explanation for the higher percentages in this study might be due to the fact that the nurses in the current study were from various departments and obtained different levels of education; taking into account that the study was conducted among both males and females. Moreover, the number of the participants in this study was more than the number of the participants in Alotabia et al. (2011) study which was conducted only on 26 females who only worked in one department. Hence, it was indicated that the participants in Alotabia et al. (2011) study were less knowledgeable about ionizing radiation than the participants in the current study.

Moreover, the percentages were higher than that of (Sampong et al., 2015) whose subject was limited to only 43 nurses, and was conducted only in Korle –Bu teaching hospital.The mean scores obtained in the knowledge assessment for (6.43±2.839, 37.8%) were less than 50% of the total mark. The possible explanation for the higher percentages in this study might be due to fact that the number of the participants in this study was more than the number of the participants in Sampong et al. (2015) study and the fact that the last mentioned study was only conducted on 43 nurses. Hence, it might be assumed that the participants in Sampong et al. (2015) study were less knowledgeable about ionizing radiation than the participants in the current study.

Eventually, the overall rate of knowledge and the overall rate of attitudes in this study were higher than (Luntsi et al., 2016), across- sectional survey among 188 registered nurses from three tertiary hospitals in Maiduguri metropolis in Nigeria. The majority of nurses had an average knowledge on radiation and the study has also found that the respondents had positive attitudes towards ionizing radiation. In addition, 70% of them practiced good radiation protection. The possible explanation for the differences in percentages in this study and the study of Luntsi et al. (2016) canbe forwarded for the reason that nurses in the current study were from different educational levels and the number of participantsin this study were more than the number of participants in Luntsi et al.(2016) study which involved just 188 registered nurses.Thereby, it might be assumed that they were less knowledgeable about ionizing radiation than the participants in the current study.

Furthermore, our findings were inconsistent with that of (Ayyasrah, 2003), done in New York City metropolitan area, among 219 registered nurses.The overall mean of knowledge score was(M=2.23, SD=.99).The possible explanation for the differences in percentages in this study and Ayasrah's study could be because of the fact that the nurses in the current study had different levels of education and the number of participants in this study were more than the number of the participants in Ayyasrah's study which just involved 219 registered nurses.Therefore, it might be assumed that they were less knowledgeable about ionizing radiation than the participants in the current study.

In addition, the findings of this study were inconsistent with that of (Dianati et al., 2014); across-sectional descriptive study that used a census sampling. The study was set in the Intensive Care Units of Shahid hospital of Kashan, Iran among 44 intensive care nurses. The mean of participants' radiation protection knowledge was 4.77±1.38, while the most prevalent radiation protection behavior of nurses was leaving the Intensive Care Unit during portable radiological examinations. Only 6.8% of nurses decided to stay at the nursing station during radiological examinations.

Moreover, the findings of this study seemed to be also inconsistent with, a descriptive study that was conducted among 200 operation rooms from 6 affiliated hospitals of H University hospital in South Korea. Noticeably, the average score for radiation protection knowledge was (8.68±2.65), whereas the average score for performance towards radiation protection behavior was (3.16±.67) (Jeong and Jang, 2016).

This study registered higher percentages than a descriptive study aimed basically to investigate the knowledge of radiation protection and the performance of radiation protection behaviors among 191 preoperative nurses in Korea. The average knowledge of radiation protection was 7.57±3.45 out of 16, while the average score for the performance of radiation protection behaviors was 4.32±.23. Subsequently, the personnel should receive further education and training to know more about radiation safety (1.40±.89)and the appropriate use of lead apron (3.79±1.13). Moreover, pregnant workers should be carful when exposed to radiation. (Gum and Nam, 2013).

The possible explanation for the differences in the percentages and rates; especially regarding the levels in this study on one hand, and Gum and Num. (2013) study on the other handwas basically because the nurses in the current study were from different departments and the number of participants in the current study were more than the number of the participants in Gum and Nam. (2013), Joeng and Jang. (2016), and Dianati et al. (2014) studies whose participants were just from only department and involved only a small number of participants.Thereby, it might be assumed that they were less knowledgeable about ionizing radiation than the participants in the current study.

This study findings were lower than a descriptive study which was conducted among 27 nuclear medicine nurses at Putrajaya hospital in Malaysia for the purposes of investigating radiation knowledge and awareness on radiation safety. The findings revealed that the mean score for the area of general radiation

knowledge and awareness on radiation safety were (7.95±.57) and (7.26±.66); respectively (Yunus et al., 2015). The possible explanation for the lower percentages and the overall scores in Yunus et al. (2015) study was simply because of the fact that the nurses attended various training programs about ionizing radiation, so it might be assumed that they had a higher level of knowledge and awareness about ionizing radiation than the participants in the current study.

There was no significant correlation between practices of participants towards protection from ionizing radiation and their knowledge. This result seemed to be inconsistent with that of a quantitative and descriptive study which was conducted in seven hospitals located in six country side cities of the State of Sao Paulo among 30 nurses who were working in the surgical center. This study has shown that the individuals who had a better knowledge towards ionizing radiation were more engaged in preventive practices; especially when all nurses working in the surgical center were trained of how to get protected from unnecessary exposure (Fabiiola and Poveda, 2015). As a result, future health associated problems would be minimized and safer work conditions would be provided to the staff which in turn was significant at the.01 level (p=.019). Moreover, there was a statically-significant positive correlation between knowledge and the performance of radiation protection behavior (p=.02). Therefore, nurses with higher knowledge of radiation protection have shown a higher performance towards radiation protection behavior (Jeong and Jang, 2015). However, this appeared to be inconsistent with the current study at which there was no statistically-significant positive correlation between knowledge and practices of nurses. In addition, this result was supported by (Flor and Gelbcke, 2013); a qualitative study conducted in the hemodynamic service of Santa Catarina, Brazil among nurses working in the Cardiac Catheterization Laboratory. This study stated that any individual who has better attitudes towards ionizing radiation are more engaged in preventive practices, which in turn was significant at the.01 level (p=.02).

The levels of knowledge, attitudes, and practices were positive in this study. However, the level of knowledge should be maintained; while the level of attitudes and practices should be developed among nurses in Jordan so as to be up–to dated and reach their highest levels.

Improving the attitudes and practices towards ionizing radiation will in turn enable the Jordanian hospitals to take over their responsibilities of monitoring and evaluating radiation protection safety, publishing information related to radiation protection, making these updates available to the providers and receivers of medical care services, training as well as educating the providers and receivers of medical services about the concept of radiation, as well as its complications to be protected from unnecessary exposure and eventually improve the overall perception about ionizing radiation.

5.3 GENERAL KNOWLEDGE, ATTITUDES AND PRACTICES OF STUDY PARTICIPANTS

In this study, the levels of knowledge, attitudes and practices among nurses were higher than other health care professionals and this might be attributed to the tasks' differences between nurses and other health care professionals. To be more specific, most nurses tend to work for longer hours in the field of nursing and seem to have more direct contact with patients than other health care providers. Therefore, this would give them the chance to obtain better skills, practices,and knowledge experiences on how to protect patients from unnecessary radiation risks. In addition, nurses should have good knowledge of ionizing radiation to know how the patient should be sufficiently prepared for radiographic examinations and be efficiently able to answer any question they might be asked about radiation hazards. Therefore, most of the nurses in Jordan should read more about radiation.

Most of Jordanian nurses were able to identify and answer correctly when they were asked about (ALARA) principles (84%).This percentage was in fact considered higher than those found in other studies such as (Alotabi, 2011); a cross-sectional among 26 non-Kuwaiti female nurses working in Kuwait government and private hospitals.

However, this was inconsistent with the study of Alotabi and Saeed (2006); a pilot study conducted among 35 radiology nurses in radiology departments representing seven Kuwaiti government and private hospitals. Only 12% of nurses were familiar with ALARA principles, while 100% of nurses answered correctly that children and pregnant mothers are more sensitive to radiation. However, a small proportion of nurses in the current study disagreed about the entrance of children to the Cardiac Catheterizing Unit. However, the congenital malformation was considered to be the most serious effect and demonstrated that the risks of radiation induced effects on children were more than the adults. Cardiac catheterizing departments and other similar intensive care units experienced a higher level of exposure to ionizing radiation. Patients in these units might need "two to four films per patient per week; especially for the purposes of "inserting pulmonary arterial lines and central venous lines, or implanting temporary pacemakers. On the other hand, the operation room which experienced lower radiation exposure levels and emergency departments were considered to be still less. In addition, more than two-third 77.8 % of nurses before training answered correctly about the basic principles of radiation safety (shielding, time, and distance). Consequently, this was inconsistent with the current study

which in turn indicated that nurses might have a basic familiarity with the concept of ionizing radiation. Moreover,this appeared to be consistent with the report of IPEM and RC (Institute of Physics and Engineering in Medicine in association with the Royal College of Nursing), in 2002, which considered that nurses play an important role as patients advocate.

About half 48.1 % of nurses responded correctly to the question about the safest place to be protected from radiation action. This was consistent with the current study, which in turn indicated that these nurses left the department during x-ray exposure. Only 30% of nurses answered correctly about the best material for manufacturing protective clothes, while only 23% of nurses answered correctly about the dose and the equality of portable radiography compared with computed scan. Moreover, only 13.6% of nurses answered correctly about the safe distance from the sources of radiation when performing portable radiography. Nearly 10% of nurses were standing behind a lead apron during radiation exposure, but most of nurses did not wear a lead apron during exposure. Subsequently, the findings of (Dianati et al., 2014); a cross sectional study that was conducted in Iran among 43 intensive care nurse, were evidently inconsistent with those of the current study. The latter has found that a small percentage of nurses stayed in the nursing department during exposure. Moreover, there were several conflicts among nurses and the hospital administrator about the safest place during portable radiographic examinations.

About 28% of respondents answered correctly that the x-rays can be reflected from the walls of room and about 39% of the respondents were aware of ALARA principle. Moreover, nearly 70 % of the respondents asked the patient to hold the film with their hands during exposure, while nearly 45% of nurses would adhere to radiation protection protocol in the future. Furthermore, 16% of nurses preferred to hold the films with their hand during exposure,whereas 53% of the respondents believed that x-rays are definitely harmful. Thus, 38% of the respondents preferred to regularly use lead aprons as reported at Swapana et al .(2017) study which in turn was conducted among 256 undergraduate clinicians in India (Swapana et al., 2017).

Nevertheless, 11.7% of nurses were familiar with radiation units in the current study. In Ayyasrah (2003) study; a descriptive study that was conducted among 219 registered nurses in New York; it was found that the mean ratings ranged from low 1.40 to high 2.12; indicating that these respondents professed relatively a little knowledge of the radiation units. Two- third of nurses in the current study agreed on the adherence to protection ideas from ionizing radiation. This might be considered to be inconsistent with (Ayyasrah, 2003) study which reported also that (38.5%) of the respondents in their study towards ionizing radiation have shown that it is necessary to report ionizing radiation. In turn, this was inconsistent with the findings of our study and the inconsistency might be attributed to the differences in the likert scale. In addition, the study has shown that nurses most feared hearing about a nuclear leak (M=4.18). The least fear was accompanying patients during x-rays (M=2.18) and the level of fear when having x-rays for self was (M=3.94), while the level of fear when dealing with medicine therapy was (M=3.93). Moreover, it was found that nurses who did not receive any of academic programs about ionizing radiation at nursing school perceived the risk of radiation exposure as the greatest for portable radiography (M=3.65). The majority of nurses believed that radiation monitoring devices should be used all time; especially if nurses are pregnant. Moreover, the level effectiveness of training procedures should be sufficiently enhanced among nurses regarding ionizing radiation (M=2.81).

The most correct answer that was reported by nurses was that computed tomography is the most risk of radiation when they were asked to estimate the risk of ionizing radiation in different procedures, nurses in this study described relatively low risk procedures that were not involved in the applying process (the practical aspects) of ionizing radiation (Ultrasound). More than one third of nurses answered correctly that ionizing radiation increases the risk of cancer, infertility and congenital malformations. This result was compatible with that of (Jeremy et al., 2012); a descriptive study among 105 of physicians in the USA, which found that only (43%) of the participants reported that the abdomen pelvic CT increases the risk of cancer in adults.

Only 26.3% of nurses disagreed that the radiologist would give the order of a computed scan to a pregnant patient. Many websites gave more information about radiation risks resulting from CT scan and emphasized the importance of referring to adoctor rather than a practitioner because the doctor is a more suitable person to discuss these issues with as reported by (Jacob et al., 2004). In this study, most of nurses (76%) agreed that technicians would give the order (refusing or accepting) of a CT- scan for a pregnant patient and that the physicians were more likely to fear of giving orders about computed tomography (CT).

When it came to practices,Quinine et al., (1997) reported that there was no differences between physicians, who were trained about radiation protection, and those who were not. However; in Saudi Arabia and Guatemala, there was a formal radiography education and training programthat wasapplied and offered to nurses. Then, the academic radiography education and training were offered (Cowling, 2008) and (Alaamer, 2012).

Baiter et al (2011) evaluated the status of education and training in radiation protection by applying a questionnaire sent to ionizing radiation. Only 31% of nurses reported that they always wear a protective apron during exposure. This was considerably inconsistent with the study of Mojiri and Moghimbeigi (2011) which

was conducted among radiographers in Iran at which 98% of x-ray technicians reported wearing a lead apron during exposure. Thereby, this inconsistency might be attributed to the differences between the tasks of nurses and radiographers regarding ionizing radiation.

ICRP recommended that a worker had to declare her pregnancy. Work conditions should ensure that the radiation dose did not exceed about one (mSV) during pregnancy (Gabril et al., 2014).

In another study, Fabiola and poveda (2015) conducted among nurses in Sao Paulo, have found that the nursing team was better oriented about all aspects of ionizing radiation. They have also shown the importance of using protective equipment.

In the practice of setting, all nurses were braved to fully understandand apply the protocol of radiation protection, take the overall program to practice and address the hazards of possible radiological examination on the individual and community level alike (Radiological Protection center, 2001). All women in this study in their productive childbearing ageargued to improve training among health professionals; especially nurses in order to be very well-prepared for any events.

About (96%) of nurses reported that they did not attend programs about ionizing radiation in nursing school or university. Regrettably, the role of the nursing school or university should be evident by dilating the scope and increase the depth of the environmental health awareness towards ionizing radiation. This was considerably consistent with Pender, (1992),"nursing curricula often fail to address the environmental issues in depth "and Shugars reported that nurses received poor education about environmental health issues, such as those related to ionizing radiation (p.220).

In 2005, National Nuclear Energy Commission implanted a program for periodic occupational health assessment for the employees who were occupationally exposed to radiation (Rita and Francine, 2013).

In Turkey, there was no course for health professionals about radiation safety, radiation protection and biological effects ofradiation, which should be included in the educational courses of health professionals. Atomic Energy Agency offers lectures on ionizing radiation in Turkey (Gower et al., 2002) and (ICRP, 2005).

Moreover, (European Association of Nuclear Medicine), (European Federation of Organization in Medical Physics), (European Society of Radiology), and others conducted a wide survey with 35 European countries in order to evaluate the current conditions of radiation protection education and training on the part of medical professionals (Baitral et al., 2014). It was found that receiving education about using ionizing radiation in medicine department would decrease and fight the excessive fear from ionizing radiation.

5.4 DIFFERENCES IN KNOWLEDGE, ATTITUDES AND PRACTICES' SCORES BASED ON THE DIFFERENT CHARACTERISTICS OF THE STUDY SAMPLE.

In the current study, participants from the Cardiac Care Unit (0.2%) obtained the highest mean practice score (4.2069), while participants from the Intensive Care Unit (10.2%) obtained the lowest practice scores (3.5833). Thus, these differences in practices' scores might be attributed to the workload in each department. It is a matter of the fact that it was observed that the Cardiac Care Unit was among the over crowded departments with patients than other departments, so nurses usually had a considerable work load.

A possible reason for this finding might be that the Cardiac Care Unit includes nurses from the younger age group, while the Intensive Care Unit includes older nurses. A possible reason might be that older curriculum might have not contained anything about ionizing radiation practices. Furthermore, it was postulated that nursing practices might decline with time, while younger nurses would be more capable of retraining what they have just practiced. This was further supported by the oncoming findings of this study.

Accordingly, it seemed that the recent graduated nurses had a better ability to recall what they practiced, resulting in a better overall practice than their seniors who might have lost some practice with time.

These findings again pointed out that there was an urgent need for some refreshing practices activities that should be held out for health care providers in governmental hospitals.

Although the overall rate of attitudes in this study was generally good, the highest attitudes' score was found in the Cardiac Catheterizing Unit (4), whereas the lowest attitudes' score was found in the operation room (2.1143). However, it seemed that they were interested in the topic of ionizing radiation in the work department and in the field of nursing in particular.

Participants from the pediatric floor obtained the highest mean knowledge score, while participants from the Cardiac Catheterizing Unit obtained the lowest mean knowledge scores. Depending on this, it seemed that the senior had a better ability to recall what they learned, resulting in a better overall knowledge than their juniors who in turn might develop some more knowledge within some more years of experience. This difference in knowledge might be attributed to the workload in each department, as some departments might have a big workload while others might not. These findings again pointed out that there was an urgent need for some refreshing knowledge activities that should be held out for health care providers at governmental hospitals. That was considerably consistent with across- sectional study among 35 radiology nurses working in radiology

departments representing seven Kuwaiti governmental and private hospitals, which reported that the knowledge of radiation protection might be acquired from working experience (Alotaibi and Saeed, 2006) .

5.5 Limitations of the study
This study was limited to nurses who were members of the Ministry of Health and only who lived in the central region of Jordan. Thus, this might impede the generalization process of the results on nurses in other governmental hospitals or private hospitals.
Moreover, the study was limited to a group of health care professionals, so the results cannot be generalized to other health care professionals, who might also be exposed to radiation in their occupations.
In this study, a cross sectional study was applied by using a convenient strategy, which in turn increased the selection bias.
The data were collected depending on self-administrated questionnaires, so it might be subjected to over, under, or inaccurate reporting.

5.6 SUMMARY
This chapter discussed the major findings of the current study. These findings were basically related to the levels of knowledge, attitudes, and practices towards ionizing radiation among nurses working at governmental hospitals in the central region of Jordan. It also iinvestigatd any factors related to the level of knowledge, attitudes, and practices of nurses as well as compares the findings of our study with those of previous studies; especially the findings related to ionizing radiation.

VI. Conclusions And Recommendations

6.1 CONCLUSIONS:
-The significance of this study arises from the fact that it is the first study in Jordan that basically surveyed nurses in order to assess their knowledge, attitudes, and practices about ionizing radiation and eventually redirect their attitudes and practices to fulfill the premium quality of health care with the least possible health risks among health care givers.
-This study revealed that the most of nurses who worked at governmental hospitals of the Jordanian Ministry of Health in the central region had an excellent level of knowledge, good attitudes, and good practices regarding ionizing radiation. However, there is more need to improve the curriculum content of ionizing radiation in the nursing institutions.
-Knowledge, attitudes, and practices of nurses working in the departments of the Jordanian Ministry of Health in the central region of Jordan did not vary significantly among different work departments.
-Knowledge of nurses working at governmental hospitals of the Jordanian Ministry of Health in the central region varied significantly among nurses who belonged to different years of experience.
-Practices of nurses working at governmental hospitals of the Jordanian Ministry of Health in the central region varied significantly among those nurses who had different age groups.
-Education, training and communication are required to protect nurses from any problem that was discussed throughout the study.
-Most of nurses placed more trust on the work department coverage of ionizing radiation issues than other sources. Furthermore, most of nurses mentioned that they were not trained enough about ionizing radiation hazards at their work. Thereby, nurses and other health care providers should be sufficiently and efficiently trained about the necessary principles and protocols despite the fact that most of nurses in this study appeared to be knowledgeable about ALARA protocols and some other principles in order to be protected from unnecessary ionizing radiation. Thus, they would show up a higher performance towards radiation protection behaviors.
 - The outcomes of this study provide a baseline data for policy makers and for future researches.

6.2 RECOMMENDATIONS
-We recommend seminars and symposium on a regular basis within the hospitals to train all nurses regarding radiation protection.
-Furthermore, it is of great importance to conduct several research papers and courses about ionizing radiation among nurses in nursing schools and universities in order to prepare a team of qualified professionals, raise the level of awareness and educate student nurses about the hazards of ionizing radiation. In addition, radiation should be included in the teaching curriculum of medical and nursing students.
-Further Studies need to be carried out about ionizing radiation in order to evaluate the patients' satisfaction when compared with the nurses' knowledge and practices regarding ionizing radiation as well as with proper and adequate training on the part of nurses.
- Most efficient communication should be established between Jordanian governmental hospitals and various private hospitals, which in turn can be achieved by assigning a representative of the hospital in each sector that

will be responsible for the exchange of the information between health care professionals on one side and the hospitals on the other side.

References

[1]. American Nurses Association (2015), **Nursing scope and standards of practice**, 3rd Edition .www.amazon.com .
[2]. Bogdanich, W. (2011), Radiation boom. **New York Times,** Website 2010-2011, http://topic<u>s</u>. anytime's. com\top\news\us\series \radiation boom \index, html= oldest &Accessed February 28, 2011.
[3]. Bushberg, J.T. Seibert, J.A. Edwin, M.L. and Boone, M.J. (2002), Essential physics of medical imaging, 2nd ed. **Lippincott Williams and Wilkins**. Philadelphia.
[4]. Bushong, S.C. (2012), radiologic science of technologists: physics. **Biology and protection** (10th) Mosby: St, Louis.
[5]. Bogdanich, W. (2011), Radiation boom. **New York Times,** Website 2010-2011, http://topic<u>s</u>. anytime's. com\top\news\us\series \radiation boom \index, html= oldest &Accessed February 28, 2011.
[6]. Bushberg, J.T. Seibert, J.A. Edwin, M.L. and Boone, M.J. (2002), Essential physics of medical imaging, 2nd ed. **Lippincott Williams and Wilkins**. Philadelphia.
[7]. Bushong, S.C. (2012), radiologic science of technologists: physics. **Biology and protection** (10th) Mosby: St, Louis.
[8]. **National Research council** (1999), Committee on the biological effect of ionizing radiation. Health effects of exposure to low-levels of ionizing radiation, Washington: National academy press.
[9]. **National Research council** (1999), Committee on the biological effect of ionizing radiation. Health effects of exposure to low-levels of ionizing radiation, Washington: National academy press.
[10]. **U.S. Department of Health and Human Services,** (1988), Guidelines for protection the safety health of health care workers PHS, CDC, NIOSH: Washington DC:US Government Printing Office, Publication, 88-119.
[11]. **U.S. Department of Health and Human Services,** (1988), Guidelines for protection the safety health of health care workers PHS, CDC, NIOSH: Washington DC:US Government Printing Office, Publication, 88-119.