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Knowledge and Practices of Governmental Hospital Physicians about Health Risk of Ionizing Radiation in Gaza Governorates

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Knowledge and Practices of Governmental Hospital Physicians about Health Risk of Ionizing Radiation in Gaza Governorates

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الإهداء

إلى من كلت أنامله ليقدم لنا لحظة سعادة

إلى من حصد الأشواك عن دربي ليمهد لي طريق العلم

إلى القلب الكبير .... والدي العزيز

إلى من أرضعتني الحب والحنان

إلى رمز الحب وبلسم الشفاء

إلى القلب الناصع بالبياض ....والدتي الحبيبة

إلى من تطلع لنجاحي بنظرات الأمل ... زوجي العزيز

إلى القلوب الطاهرة الرقيقة والنفوس البريئة إلى رياحين حياتي... أخواتي

إلى الصامدين على ثرى فلسطين الحبيبة

رانيه إبراهيم الاسطل

Declaration:

I Certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any of the part same) has not submitted for a higher degree to any other university or institution.

Signed:.................................

Rania Ibraheem Alastal

Date: 22-12-2009

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Abstract

Ionizing Radiation (IR) is widely used in medicine, especially in diagnostic investigations and therapeutic procedures. It is well-known that ionizing radiation is risky to humankind. Therefore, the benefits from carrying out radiological investigations and therapeutic procedures should exceed its anticipated risks. However, physicians play a role in exposing patients to this radiation as they request these radiological examinations. So, this study has been designed to assess the level of knowledge and practices toward ionizing radiation risks among physicians in order to improve their practices and subsequently to reduce patients' exposure to risks.

The study is a cross sectional one; conducted in three governmental hospitals; Shifa, Nasser and the European Gaza Hospital. The participating physicians were about 300 selected via a proportional stratified sampling procedure. The administrative and ethical considerations were taken into account. A self-administered questionnaire was distributed to the selected physicians and 210 completed the questionnaire with a response rate of 70%.

Using a scoring system for assessing knowledge, the study findings indicate that physicians' knowledge towards IR risks was relatively low (less than 56 %). Only 14% of them had a high knowledge in this regard. Regarding physicians' practices, although it was slightly higher their knowledge (58%), still it was relatively low. Only 24% of physicians reported appropriate practices. Additionally, the study showed that there are no statistically significant variations in knowledge and/or practices among participants in relation to age, education and place of work. Moreover, there are no statistically significant variations in neither the knowledge nor the practices among the study subjects in reference to work related factors including; years of experience, experience in radiology department, type of specialty and department. In contrast, participants who use x-ray in therapeutic interventions (guidance) reported more appropriate practices than their counterparts who do not and the variation among the two groups were statistically significant (P value less than 0.05).

According to the results, increasing the knowledge of physicians about IR risks and training them about radiation protection are priority issues. Also developing an imaging protocol to help physicians to promote standardized safe practices is a serious responsibility of the decision makers

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Abbreviations

AAPM	American Association of Physicists in Medicine
ALARA	As Low As Reasonable Achievable
α	Alpha radiation
ANOVA	Analysis Of Variance
ARS	Acute Radiation Syndrome
BIER	Biological Effect of Ionizing Radiation
β	Beta radiation
CDC	Center for Disease Control and prevention
CSAPH	Council on Science and Public Health
CT	Computed Tomography
DNA	DeoxyriboNucleic Acid
EC	European commission
EGH	European Gaza Hospital
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
γ	Gamma ray
Gy	Gray
ICRP	International Commission on Radiation Protection
IR	Ionizing Radiation
IAEA	International Atomic Energy Agency
IARC	Interventional Agency for Research on Cancer
LNT	Linear Non Threshold
MOH	Ministry of Health
MRI	Magnetic Resonance Imaging
NAPBC	National Action Plan on Breast Cancer
NRC	National Research on Cancer
RERF	Radiation Effects Research Foundation
SPSS	Statistical Package for Social Science
Sv	Siveret
U/S	Ultrasound
U.S.	United States
UK	United Kingdom

WHO	World Health Organization
USNRC	United States Nuclear Regulatory Commission
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation

Definitions

- **Ionizing radiation** the radiation which has enough energy to remove an electrons from the atoms that pass through it (EPA, 2007).

- **Knowledge** Is the capacity to aquire, retain and use information; a mixture of comprehension, experience, discernment and skill (Badran, 1995).

- **Practice** A type of process or structure whose application reduces the probability of adverse events resulting from exposure to the health care system across a range of diseases and procedures (Agency for Healthcare Research and Quality, July 2001).

- **Radiation** is a transfer of energy from a source (WHO, 2008).

Chapter One

Introduction

Chapter One

Introduction

1.1 Background

Radiation is around us and everywhere. Emitting energy from a source such as heat, light and radio waves is called radiation. When radiation passes through atoms, and has a sufficient energy to cause changes to atoms, it is called ionizing radiation (IR) according to the World Health Organization(WHO), 2008.

IR has energy when transferred through a living tissue that can cause change to cell components. In general, severity or types of health effects are influenced by the amount and duration of exposure, but health effects are not fully understood. So there is no safe level for exposure to IR, even at very low doses there is a probability for inducing cancer (National Research on Cancer (NRC), 2006).

IR has been used since over a century for medical purposes and applications, where it has become an essential tool for diagnosis and therapy. The speed of conducting the medical procedures which use IR has resulted in a faster diagnosis. Diagnosis benefits from IR procedures lead to widespread practice of medical radiology (United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), 2000).

The x-ray is a type of IR widely applied in medicine with many equipments and varied procedures for using it. A technology revolution of medical instruments has become more complicated during the last three decades. A conventional x-ray instrument had firstly appeared with the discovery of x-ray. During x-ray imaging, the rays are transferred through the desired organ, and the absorption of x-ray takes place by different tissues with varied degrees due to varied densities among tissues. The x-ray is not totally absorbed and the remaining x-ray exits from the body and interacts with a detection device (x-ray film). After developing the film an image of two dimensions of the tissues appears on it. So it gives a picture about an anatomical region showing if any abnormality exists (Food and Drug Administration (FDA), 2002). The fluoroscopy is an x-ray unit with a screen used for dynamic imaging; it is mostly used with an enhanced media called contrast media to visualize a soft tissue as gastrointestinal tract , urinary tract and within arteries and veins (FDA, 2008, UNSCEAR, 2000). The computed tomography (CT) is a complex unit, that uses an x-ray and a computer system to give a series of sectional images, and so it provides a third dimension through these series. There are many generations of CT and a high technology is used with it. It has been a great revolution in CT technology (FDA, 2002). Interventional Radiology used a fluoroscopy unit mostly for doing medical interventions under screen; such as drainage, coil immobilization , filter placement and angioplasties (Reek, 2004).

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) has a continues review of sources of IR exposures. It is reported that the medical uses are the largest man-made source of exposure to IR for the world's population. It also made a global survey for medical practices based on national information and surveys. It also concluded that there are increases in the annual frequency of diagnostic medical exposures in most countries across the world. In the United Kingdom, it increased from 800 per 1000 persons in 1990 to 962 per 1000 persons in 1996, while in Japan, it increased from 1160 in 1990 to 1447 in 1996 per 1000 individuals of the population. Kuwait also showed an increase from 720 persons in 1990 to 896 in 1996 per 1000 of the population (UNSCEAR, 2000).

IR used in medical diagnosis and intervention is considered as low IR. Although the risk from these procedures seems very small to an individual, it can be bigger if there is a large number of people exposed, and if these procedures are repeated many times (Dickie and Fitchew, 2004).

1.2 Problem Statement

In Gaza hospitals, there is a noticeable increase year after year in IR examinations according to the Ministry of Health directorate general of hospitals.

Many patients come to Radiology department without any knowledge about the potential risks and benefits of radiography. The patients come either with over risk perceptions or with under risk perceptions. Patients feel more confident and satisfied with the results of these procedures more than with the clinical diagnosis of physicians without making it. Also, some patients visit the Radiology department with more than one radiological request, like lumber x-ray and lumber CT or sinus x-ray and sinus CT, and other inpatients have an x-ray without any clinical benefit. These observations and situations motivate the researcher to look up for physicians knowledge and practices about IR risks .The researcher found that physicians' knowledge about IR is either not known or their practices .

So this study was an attempt to investigated the knowledge and practices of physicians towards x-ray requesting as a tool for medical diagnosis, and how to increase the knowledge and to improve the practices of physicians about IR.

1.3 Justification

There is no safe level for exposure to IR, even at very low doses there is a probability for inducing cancer (NRC, 2006). Since the risk from the exposure is very low and may appear after decades, it is easy to the physicians to close their eyes about these small risks (Dickie and Fichew , 2004). The growing in the medical field may lead to increase exposures to large numbers of patients, which can be a concern for public health in spite of the small risk from radiation (FDA, 2007).

It is the responsibility of physicians to weigh the risk versus the benefit from these investigations, and to make sure that the patient will have a benefit greater than the risk (Rehani and Beryy, 2000). Physicians are responsible to minimize the risk from radiological examinations by avoiding unnecessary radiological examinations (Burry, 2002) and using the lower IR examination when it is effective in diagnosis, and using non IR examination when the benefit in diagnosis as ionizing examination (FDA, 2001).

1.4 Objectives

1.4.1 General Objective

To asses the knowledge and practices of physicians about ionizing radiation in Gaza governorates hospitals

1.4.2 Specific Objectives

1. To determine knowledge level of physicians about IR, exposure and possible risk.
2. To assess physicians practices regarding IR.

3. To explore the relationship between physicians' knowledge and sociodemographic factors such as age, educations, and hospitals.
4. To explore the relationship between physicians knowledge and work related factors such as experiences years, experience status in radiology departments, type of department, using x-ray in interventional practices and specialty.
5. To explore the relationship between physicians' practices emographic factors.
6. To explore the relationship between physicians practices and work related factors.
7. To suggest recommendations which may help improve IR knowledge and practices among physicians.

1.5 Geography of Gaza Strip

Gaza Strip is located on the south eastern coast of the Mediterranean Sea. Its position on the crossroads between Africa to Asia made it a target for occupiers and conquerors over the centuries. In mid year of 2005, the population number was estimated at about 1,389,789 mainly concentrated in the cities, small village, and eight refugee camps that contain about two thirds of the population of Gaza Strip. There are five governorates in Gaza Strip: North of Gaza with a population of about 265,932 , Gaza city with a population of about 487,904 , Mid-Zone with a population of about 201,112, Khanyounis with a population of about 269,601and Rafah population was about 165,240 individuals in 2005 (MOH, 2006).

1.6 Governmental Radiology Services in Gaza Strip

The Ministry of Health (MOH) provides radiological services mainly through hospitals. In Gaza governorates, there are 13 governmental hospitals, and only 11 of them provide radiology services. The ophthalmology, and psychiatry and mental health hospitals do not provide these services.

All of the eleven hospitals provide Ultra-sonography (U/S), routine x-ray and is supposed to provide fluoroscopy procedures in their departments also but there are some defects in some hospitals. While four of these hospitals have CT units and three hospitals have mammography units. Only two hospitals have panorama units.

Magnetic Resonance Imaging (MRI) which is a non-ionizing imaging unit is not available expect in one hospital begun working since May, 2008. Regarding nuclear medicine and radiotherapy, there are some machines at Al-Amir Nayef Center in Shifa hospital, but they have never been operated because of the Israeli siege imposed on the Gaza strip.

Only 14 of the primary health care clinics and centers have a routine x-ray service. According to the records of hospitals directorate general, about 395,297 radiological diagnostic procedures were done in 2008;of them 41,168 ultrasound and 746 MRI procedures. Radiology department has noticed that there is an increase in the frequency of radiological procedures year after year and there is no rational use for them (Annex 1).

Forms of requesting an x-ray require just the signing of a physician after completing it, while for U/S and fluoroscopy it requires a specialized physician to request any of them, and for the CT, the head of department should stamp the request form (Annex 1). But at a professional level there is no adherence to these instructions from most of the physicians; the head of Shifa radiology Shifa department has assured this.

Regarding the MRI there is a committee that meets every week to evaluate the requests and decides if it is necessary to do it.

1.7 Cancer in Palestine

The cancer cases reported in the2005 were about 1,623 with incidence rate of 49.2 per 100.000 in West Bank and 32.7 per 100,000 in Gaza Strip. According to MOH report, the incidence of cancer is higher for female than male. The breast cancer is the highest among female Palestinian population and lung cancer is the highest among male Palestinian population (MOH,2006).

The mortality rate from cancer increased from 27.4 in 2000 to 27.8 in 2005 .The trachea , bronchus and lung cancer is the highest cause to deaths among cancer mortality (MOH,2006).

Chapter Two

Literature review

Chapter 2

Literature

2.1 Conceptual frame work

Knowledge is a capacity of acquiring retaining and using the information, it is a mixture of experience and skills (Badran,1995).

Practice is an application of a process to reduce the adverse effect result from exposure to health care system (Agency for Health Care and Quality, July 2001).

Theoretically the researcher supposed that there is a relation between age, education and place of work (hospital) with the knowledge and practices of physicians regarding IR risks. Also the researcher supposed that work related factor as experience years, experience status in the radiology department, specialty degree, department and using the x-ray status should affect knowledge and practices of physicians regarding IR risks. The researcher will study this relationship and seek their effect.

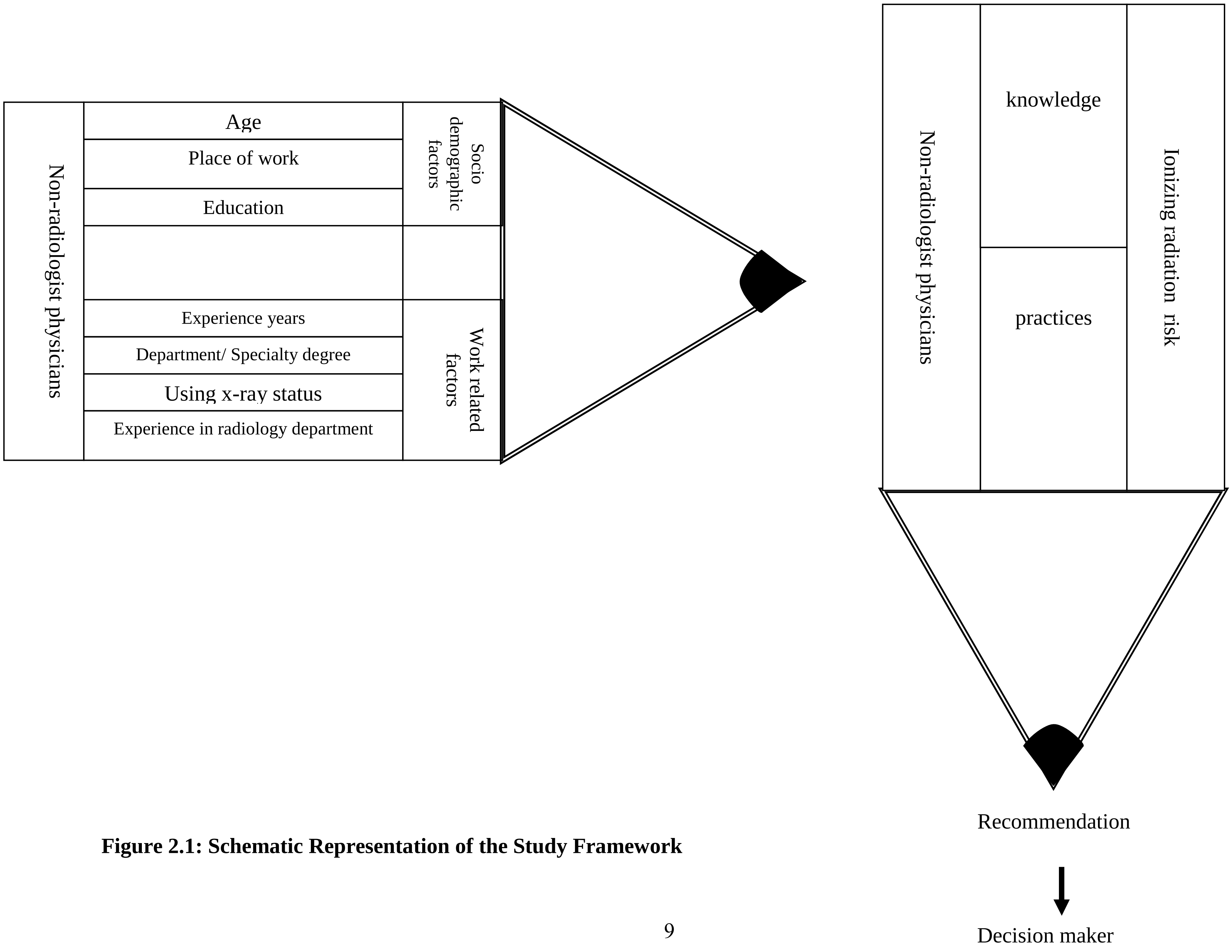

Figure 2.1: Schematic Representation of the Study Framework

2.2 Ionizing Radiation

Radiation is a transfer of energy from a source (WHO, 2008).When the radiation has enough energy to remove electrons from the atoms that pass through it, it is called ionizing radiation (IR). IR ejects electrons from the atom which are negative ions so the atom becomes a positive ion (Environmental Protection Agency(EPA), 2007).

Many elements found in nature are considered as unstable. They are called natural radioactive elements because they tend to become stable by emitting radiation according to the International Atomic Energy Agency (IAEA), 2004. The radioactive elements have nuclei either with too many or two few neutrons in comparison to its number of protons (IAEA ,2004). To become more stable, it emits subatomic particles and high energy waves. Emitting particles as alpha (α) and beta (β) radiation from radioactive nuclei is called a radioactive decay.

Alpha radiation (α) is positively charged particles that consist of two protons and two neutrons (the nucleus of a Helium atom); it is emitted from heavy unstable nuclei. An alpha radiation has a high mass which is responsible for slowing its transfer and speed (1 - 2 cm in air) (Burnham, 2001).

Beta (β) radiation is an electron (a negatively charged particle) emitted by unstable nucleus. Beta particles have a negligible mass so they are faster than alpha particles (Burnham, 2001). After emitting a beta particle, the nucleus often is still unstable because of excess energy which is emitted as gamma rays (γ). Gamma rays are packets of photons that have neither mass nor charge. These rays are very fast and they have very penetrating power (Burnham, 2001). X-ray, like γ-ray, is high energy photons but it is produced by the disturbance in the electron of atoms (Burnham, 2001).

X-ray and γ-ray are considered as electromagnetic radiations because they consist of both electric and magnetic fields (Burnham, 2001). Particulate radiation is a radiation composed from particles emitted from the atom at a high speed and a high energy like α particles, β particles, protons and neutrons (Burnham, 2001).

2.3 Ionizing Radiation Dose and Units

Ionizing radiation interacts with the matter by depositing energy which is called the absorbed dose. The absorbed dose is expressed in a unit called Gray (Gy). Each type of radiation has its own characteristics and composition, so it has its own risk to a tissue. For example, one Gy of α particles emitted to a tissue is more harmful than one Gy of β particles because of their heavy mass and charge. The equivalent dose takes into account these variations. It is equal to the absorbed dose multiplied by a radiation weighing factor which equals 20 for α particles, while for β particles, γ and x-rays it is 1.The equivalent dose is expressed in a unit called Siveret (Sv), so 1 Sv of α particles emitted to the lung has the same risk of 1 Sv of γ rays. But the risk of the same equivalent dose is not the same for all tissues due to its own composition and sensitivity. The effective dose solves this problem, and it is also expressed in Sv. The equivalent dose is multiplied by a tissue weighting factor that is related to the sensitivity of a tissue to radiation. The sum of weighted equivalent doses for major organs and tissues is the effective dose (IAEA, 2004).

2.4. Natural Background Radiation

Many people are exposed to more than one source of IR, but no one is exposed to none. IR exists in nature; it is found in soil, water and air. In addition, there is a man-made IR which is used for many purposes (UNSCEAR, 2002).

There are different sources to natural IR. Cosmic rays are a source of exposure to IR. Cosmic rays are particulate radiation -mostly protons- coming from the sun and from the outer space. This particulate radiation is absorbed through the atmosphere which covers the earth surface. The absorption occurs by interaction with air components, so the exposure to cosmic rays at higher elevations is more than that at lower elevation and at the sea level. Altitude plays a role in the exposure to natural IR (Burnham, 2001, UNSCEAR, 2002).

The second source of natural IR is the terrestrial radiation. There are many radioactive nuclei in the rocks and soil; through their decay, they emit γ rays. People exposed to these radiations, either externally or internally, by eating food, drinking water, or inhaling air which contains radio nuclides(Burnham, 2001, UNSCEAR, 2002).

Radio active nuclei decay through a chain process producing daughter radioactive nuclei until they reach to a stable state. Radon gas is a radioactive one and it is produced through a chain decay of uranium. Radon gas which has no odor, color or taste enters the body through inhalation (Burnham, 2001). Through its decay, it produces α and β radiations. It enters homes through the cracks in floors and walls or building materials which may contain radio nuclides (WHO, 2004).

Doses received by the population from natural radiation vary according to latitude, types of rocks and soil and altitude. Houses also differ in the amount of IR due to the type of building materials and vacuum through it. The worldwide annual average effective dose is 2.4 mSv (mSv is one thousands of Sv). Radon gas contributes to 50% of natural background IR (UNSCEAR, 2000).

2.5 Man Made IR

People may expose to IR through several activities and practices from man made sources. These include many uses as nuclear weapons testing, using nuclear power reactors in generation of electrical energy and medical uses. People are exposed to IR either their closing to nuclear reactor / testing site, by their working in these places or as patients through their diagnosis treatment trip (UNSCEAR, 2000).

The chernobyl nuclear power plant accident was a serious one that happened on the 26^{th} of April, 1986 where the plant workers and the surrounding areas had been exposed to very high dose of radiation (UNSCEAR, 2000).

2.5.1 Nuclear Weapons Testing

Testing a nuclear weapon either in the atmosphere or underground usually results in releasing radioactive materials which are deposited in the environment. The world average annual effective dose was 0.15 mSv in 1963. The effective dose was higher in the northern hemisphere due to the fact that most testing took place in the North (UNSCEAR, 2000). Exposed people to this source have significantly decreased because the United State and Russia had stopped their large scale nuclear testing (Burnham, 2001). The world average annual effective dose from weapons testing was 0.05mSv in 2000 (UNSCEAR, 2000).

2.5.2 Nuclear Power Plant

The generation of electrical energy by nuclear power plants has grown since 1956. Nowadays, there is a wide expansion of this industry. Nuclear power plants and other nuclear installations, which release radioactive waste into the environment use radioactive materials. During a controlled operation of these plants, the release of radioactive materials is low. The average annual effective dose from this source is less than 0.0002mSv (UNSCEAR, 2000).

2.5.3 Medical Uses of IR:

For over a century, IR has been used in medicine, and its use has expanded by the development in technology and the advancement in technical factors. It is used either for diagnosis or in therapy and these uses have spread worldwide. The frequency of using diagnostic procedures exceeds that of radiotherapy procedures by a factor of 450 (UNSCEAR, 2000).

On global aspects, medical x-ray procedures are the most common, where about 78% of all diagnostic procedures uses IR. It is followed by dental x-rays of about 21% and diagnostic nuclear medicine of about 1%. There is a wide variation in using medical IR among the different countries (UNSCEAR, 2000).

2.5.3.1 Nuclear Medicine:

In diagnostic nuclear medicine, radiopharmaceuticals are given to patients where It is administered either by injection, inhalation or ingestion. The type of radiopharmaceutical is chosen according to the examined organ or tissue. These radiopharmaceuticals emit γ rays which are detected by Gamma camera and give a picture about the examined organ.

Diagnostic nuclear medicine procedures are not common in spite of their expansion (Shrimpton, 2001, Burnham, 2001, IAEA, 2004)

The effective dose of diagnostic nuclear procedures is similar in range to diagnostic x-ray examinations (Shrimpton, 2001). The effective dose from lung perfusion is 1mSv which is equal to the effective dose from lumber spine x-ray. The bone scan gives an effective dose about 3mSv which is equal to Barium meal examination. Some diagnostic nuclear procedures give higher effective doses than those in diagnostic x-ray (Martin et al, 2002). But according to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) survey analysis, the average effective dose per caput from diagnostic nuclear medicine is about 0.03msv (UNSCEAR,2000).

2.5.3 .2 Radiotherapy

Using IR to kill cancerous cells is known as radiotherapy. It is used either for cure or just alleviation of the disease. Treatment by radiation is induced either by focusing an external beam of IR to the target site or by implanting a radioactive source into the target site. Administration of radiopharmaceuticals to patients is also a way of conducting radiotherapy. Treatment by radiation is planned by specialized persons to deliver a high dose to the cancerous cells and little doses to the healthy tissue. Killing the tumor requires a high dose of radiation (Shrimpton, 2001), which is estimated at about 100 to 200Sv per treatment (Burnham, 2001). In 1996, there were about 0.9 treatment per 1000 of the world population according to the UNSCEAR (UNSCEAR, 2000).

2.5.3 .3 Diagnostic X-rays

Using x-ray in diagnostic procedures is the most common use of IR in medical practices. There is a wide usage of x-rays because of the various techniques and machines such as conventional x-ray, dental x-ray, fluoroscopy, computed tomography (CT) and interventional radiology (The Council on Science and Public Health(CSPH), 2006, UNSCEAR, 2000).

Some medical radiological examinations used in diagnostic procedures give an exposure higher than that from natural IR (Radiology Info, 2007). The effective dose from x-ray examinations varies from an examination to another; it is about 0.02mSv for chest x-ray which is equivalent to the exposure to Natural IR through 2.4 days in the US, while lumber spine x-ray effective dose is about 1.3mSv which is equal to the exposure to about a half year of natural IR in US (FDA, 2007), while extremities x-rays have an effective dose less than 0.01 mSv (Hart and Wall, 2002), abdomen and pelvis x-ray is about 0.7mSv. IVP examination, which is used for renal tract by giving contrast media and taking many films, gives an effective dose of about 2.5mSv (Hart and Wall, 2002), which is equivalent to a natural IR through 10 months in the US (FDA, 2007).

Fluoroscopic examinations also vary according to the types of exams. Most of the fluoroscopy examinations give an effective dose higher than that for radiography examinations. Barium meal, which is an examination for stomach, gives an effective dose of about 3mSv. Barium enema which is an examination for the large bowl, gives a higher effective dose of about 7mSv (Hart and Wall, 2002), it is equal to the exposure to natural IR through 2 to 3 years (FDA, 2007).

CT examinations expose patients to dose larger than any other diagnostic radiology examinations (Golding and Shrimpton, 2002). According to Rehani and Berry, the European Community considers CT and interventional radiology as high doses procedures (Rehani and Berry, 2000).

Abdomen CT gives a high exposure to patients, where the effective dose from abdomen CT is about 10mSv that is equivalent to 500 chest-x-rays and 3.3 years of exposure to natural IR in the US. While the head CT gives an effective dose of about 2mSv which is equal to 100 chest-x-rays and 8 months of exposure to natural IR in US (Radiology info, 2007).

Effective dose varies for the same type of examination (Wall and Hart, 1997), and from country to country (Aldrich, 2006, UNSCEAR, 2000), and even with similar patients weigh for the same type of examination due to different technical factors and processing conditions (NG et al,1998) and to different protocols and technology for CT examinations (Aldrich, 2006).

Richard et al, 2000 estimated the patient effective dose during CT fluoroscopy and concluded that patients are exposed to high exposures of IR during CT fluoroscopy-guided interventions. Exposure from CT fluoroscopy is ten times higher than the fluoroscopy exposure (Golding and Shrimpton 2002). Some advanced CT, like cardiac CT, gives an exposure to patients higher than the Japanese atomic bomb survivors' exposures at Nagasaki and Hiroshima (Breener and Hall, 2007).

A CT examination of a child patient results in a higher dose of IR than that of an adult. Abdomen CT for a pediatric patient gives him an effective dose of about 11 mSv. That is because the pediatric patients are of smaller size, and the anatomical parts are much closer to each other. So many anatomical regions will be irradiated at higher doses, even at low levels of exposure (Minigh, 2005). This seems applicable for x-ray radiography, especially for newborns (Armpilical et al, 2002), where the mean effective dose for a neonate in the special care baby unit for chest x-ray is about 7.8mSv and the abdomen x-ray of 10.9mSv (Armpilical et al, 2002).

2.6 Mechanism of IR Induced Biological Effects:

As mentioned previously, IR has enough energy to remove electrons from their orbits in the atoms to form cations. Inside a tissue, when IR interacts, hydroxyl radical is produced through the ionization of the water molecule inside a cell. These very active radicals interact with cellular components and make chemical changes. They interact with DNA (Deoxyribonucleic acid) which is an important vital molecule in the cell, and causes breaks in their strands, either the single or the double strands. DNA can also be damaged directly by interacting with IR (Mitelman et al, 2007, ICRP, ND).

The damaged parts are either being repaired by the cells themselves; the cells die, not repaired, or incorrectly repaired; hence they may cause biophysical changes (Mitelman et al, 2007, United States Nuclear Regulatory Commission(USNRC), 2004).

2.7 Categories of Health Effects Resulting from IR Exposure

The health effects resulting from the exposure to IR are classified into two broad categories: stochastic effects and deterministic effects(ICRP, ND).

Deterministic effects are those effects resulting after exposure to a large dose of IR, and that ultimately result in cells death. These effects do not occur until certain level of exposure is reached. If it is below this standard level, it will not occur. The severity of these effects increases with increasing the exposure. Deterministic effects vary because each organ and tissue has a threshold level; for example skin reddness, burns, hematological depression, sterility, cataract, radiation sickness (many symptoms; nausea, weakness, hair loss, skin burns). Furthermore, death can occur within few days, weeks or months at very high dose (Kalra et al, 2004, EPA, 2008, ICRP, ND). These effects occur because of large number of killed cells which cannot be compensated. These effects show further complication by inflammatory process and fibrosis, and may result in damage or loss of functions of tissue (ICRP, ND).

The second category is stochastic effects where the incidence is random and the probability of inducing it increases with increasing the exposure level. Inducing cancer in the irradiated person and genetic effects in their offsprings are stochastic effects. It can occur at any level of exposure, so it does not need a certain level to occur. Low level exposure can result in inducing cancer but the severity of it does not depend on the dose (Kalra et al , 2004, EPA, 2008, ICRP, ND, Gerber et al, 2009).

2.8 Health Risks from Exposure to IR

Exposure to high doses of IR can lead to severe health effects such as in radiotherapy or some accidental events. These effects may vary according to the exposure circumstances(Muirhead et al ,2007). According to UNSCEAR, Chernobyl nuclear power plant was responsible for 30 workers deaths and injuries of hundreds of workers due to radiation (UNSCEAR, 2000). Another tragic event was the atomic bombs thrown on Hiroshima and Nagasaki in August 1945 (Parthasarathy, 2001) where about 200,000 persons died by the end of 1945. These tragic results were due the pressure and head of explosion that occurred and also to acute syndromes from high exposure to IR (GSF, 2005). Many survivals from Hiroshima and Nagasaki atomic bombs had suffered from acute radiation syndrome (ARS). This syndrome occurs due to whole body exposure or most of it to high levels of IR within a short time. This syndrome has many complex symptoms like nausea, vomiting, diarrhea, fatigue, fever and skin damage. The patient may feel healthy for a short time, and then becomes sick again. The patient, if treated, may recover for several weeks or even for two years after exposure. However, the chance for survival from ARS decreases with increasing the dose (Center for Disease Control and prevention (CDC), 2006).

The survivors from the atomic bombs were about 120,000 in both cities (GSF, 2005). In spite of that, the mean of dose for this cohort of survivors is considered high about 200mSv, but more than fifty percent of them received doses less than 50mSv (Preston et al, 2004).

The survivors were studied by many researchers and many studies. The studies indicate that a subgroup of the cohort had a significant increase in cancer incidence among those who received a dose between 5 and 15 mSv with a mean dose of about 40 mSv (Preston et al, 2003, Pierce and Preston, 2000, Preston et al, 2007)

2.8.1 Risks from Medical Exposure:

Some of the deterministic effects occur after radiotherapy such as side effects which can not be avoided if the radiotherapy does not succeed (ICRP,ND). Cancer incidence increases among those who undergo radiotherapy for malignant or benign tumors in both children and adults as mentioned in various studies as reported by Muirhead et al ,2007

In interventional radiology, there are fewer doses than that of radiotherapy but it is relatively higher than for other diagnostic x-ray. So there is an increase in stochastic risks to patients as a result of diversity and complexity of interventional radiology. Also there is a risk of deterministic effects such as skin damage, especially if there is a concentration by beam on the same skin area (Dendy, 2008, FDA, 1994). There are occasional reports to the United State Food and Drug Administration of skin injuries to patients from interventional radiology, especially when they take a prolonged fluoroscopy time. In spite of the rare incidence of these risks, there are some severe cases (FDA, 1994).

According to Ron, it is difficult for epidemiologic studies to assess the effects from diagnostic radiological examinations because they are considered as low doses, except for those who have many repeated examinations. Among scoliosis patients, who had many radiographs during their late childhood and adolescences, an excess of cancer were reported. Breast cancer also increases among women with tuberculosis due to multiple chest fluoroscopic examinations (Ron, July 2003)

Ma et al, 2007 had implemented a case control study on a 1,742 women aggregate, 20-49 years, and 441 control women in Los Angeles to investigate the effect of low dose medical radiation exposure and breast cancer risk. They found that, among women who had multiple chest x-ray or mammogram as reported by them, the risk of breast cancer increased according to estrogen and progesterone receptor status, and the difference is statistically significant. Also the risk of breast cancer increased among women who had dental x-ray without lead apron protection before age 20 years, and the difference is statistically significant(Ma et al, 2007).

A cellular study shows that cells exposed to very low dose of x-ray, had double strand breaks which increase with increasing the dose. The repair mechanisms occur after a certain level of radiation, while cells exposed to very low radiation did not repair the damages according to the study (Rothkamm and Lobrich, 2003)

The Council on Science and Public Health (CSAPH) reported that, there are some studies which had indicated an excess of a relative risk for women who received high radiation doses of about 0.15 per 6 years, while women who received lower doses had an excess relative risk of 2.5. This also had been assured in studies of women receiving high doses to treat ankylosing spondylitis. The excess relative risk for whom was 0.08 compared to that for scoliosis women who received repeated x-ray examinations; an excess relative risk was 2.7. This can be interpreted by the fact that cells were killed in women who received high doses and so the risk has been reduced (CSAPH, 2006)

The Interventional Agency for Research on Cancer (IARC) has classified x-rays and γ rays as carcinogenic to human (IARC, 2000). Based on the data from the 1945 Japanese atomic bombs survivors, risk models were constructed. Gonzalez et al in 2004 made their analysis to estimate a cancer risk from diagnostic x-ray for 15 developed countries. The risk of cancer from diagnostic X-ray ranged from 0.5% to 3% for all cancers. In the United Kingdom, the risk was about 0.6, Australia with cancer risk from diagnostic x-ray was 1.3% and the highest was in Japan with 3.2% due to diagnostic x-ray (Gonzalez et al, 2004).

According to ICRP estimation of fatal cancer risk based on analysis of epidemiological data of Japanese atomic bombs survivors and other irradiated populations, 5% were estimated to have a fatal cancer after being exposed to 1Sv. The lifetime risk of inducing fatal cancer from the exposure to a single abdomen CT would be 0.05 %. That means, one patient is expected to have a fatal cancer out of every 2000 who take a single abdomen CT (ICRP, ND). European commission in their referral guidelines classified the risk from medical diagnostic procedures into four categories. The first is negligible risk category such as chest x-ray, extremities except femur and teeth x-ray. The second is minimal risk category which has a risk of developing a fatal cancer from 1 per million to one per hundred thousand such as head and neck x-ray. Third one is very low risk category, it has a risk of developing fatal cancer from one in hundred thousand to one in ten thousands such as mammography, hip, spine, abdomen, pelvic x-ray, head CT, and some diagnostic nuclear examinations as lung and kidney isotope scan. The last one is low risk category, which has a probability of inducing fatal cancer from 1 per 10,000 to 1 per 1000 such as IVP, barium enema, barium meal, abdomen CT and bone isotope scan (EC,2000-B).

The fatal cancer risk was estimated from full body CT examinations, it was about 0.08% for adult patients. That means one from 1.250 patients who undergo full body CT examinations will suffer from a fatal cancer according to this estimation (Brenner and Elliston, 2004)

Gofman had reported in his book after many studies focusing on the effect of ionizing radiation on health, that medical diagnostic x-ray contribute to 75 % of new cancer cases, and reported that the number of x-ray diagnostic procedures increases with increasing physicians, the ischemic heart diseases and cancers have also increased. He indicated that there are other confounding factors that may lead to these diseases, but he assured that more than half of them died from these diseases due to diagnostic x-ray. Gofman has predicted that diagnostic IR will be responsible for 100 million premature deaths in the next decade (Gofman,1999). In contrast, medical radiation experts consider the estimation of cancer risk from diagnostic x-ray is overestimated because this estimation is derived from atomic bomb survivors. They claim that those survivors have been exposed to significantly high levels which cannot be extrapolated to those who undergo diagnostic x-ray which is a low exposure (American Association of Physicists in Medicine (AAPM), 2007).

In spite of the lifetime risk of cancer from diagnostic x-ray, it is very low compared to natural risk of fatal cancer, about 1 to 4. But the risk from this investigation is a cumulative risk. While some patients may have very small cumulative dose, others may exceed 50mSv (ICRP, ND).

The probability of cancer occurring after exposure to IR is about five times more than of inducing genetic effects. Animal studies indicate that there is a genetic effect as a result of exposure to IR (USNRC, 2004). In spite of the fact that there is no evidence of such effect on humans scientists express their concern because they cannot prove the opposite on humans (UNSCEAR, 2001).

2.9 Vulnerability to IR:

Since there are differences in the cells formation, there are many types of cells such as nerve cells, muscle cells and so on. This variation is a result of variation in gene expression from one cell to another. This allows each type to have its own specific function and so differs in their response to IR (Radiation Effects Research Foundation (RERF), 2007). Cells which grow and multiply rapidly are more radiosensitive and pick up a radioactive material. Thyroid and breast cells are more radiosensitive than nerve and kidney cells (Burnham, 2001).

At the same age and sex, the risk of fatal cancer varies due to variation among individuals. Females are at greater lifetime cancer risk than males from IR. The effect of ionizing radiation exposure decreases with increasing the age. The children have a lifetime risk of cancer due to IR more than adults. The risk estimated to be 2 or 3 times more than the adults, while the elderly have a lower estimated risk of cancer by 5 times (ICRP, ND). This is related to vulnerability of children to IR. Thyroid, breast and gonads are more radiosensitive in children than the adults because children are still growing and cells are more rapidly dividing. In medical exposure, the small size of children permits x-ray to expose adjacent organs to the examined area. In addition to all of these reasons, child has a longer life which means that he may have a more cumulative exposure and also have a time for cancer to develop (Frush et al, 2003).

The doses received from CT are considered as moderate to high radiation of a diagnostic technique. A study conducted by Chodick et al in Israel to assess the excess fatal cancer risk in children aged < 18 years from a single CT in one year. According to their estimation, the risk decreases with increasing the age and the highest risk was among less than 3 years age groups. The study estimated the excess cancer deaths by 0.52 % in a year from single exposure to CT. In spite of that, the risk is small but it is not negligible. At more years and larger numbers being exposed and with repeated examinations, this number should be taken into concern (Chodik et al, 2007).

The fetus may be exposed to IR through exposing his mothers. The Center for Disease Control and prevention(CDC) indicates that small doses of IR to the fetus do not have teratogenic effects. It is just increasing the likelihood of risk of fatal cancer later. The risk is less than 2% more than normal occurrence of cancer (CDC, 2005). The teratogenic effects, intrauterine growth, retardation and abortion need a certain level of exposure to IR to occur, which is highly greater than those of diagnostic medical exposure (Miller , 2004, Ratnapalan et al, 2008). The risk to the fetus from exposing his mother to abdomen CT was estimated to be 0.18% in his first year of age, and 0.07 % from head CT (Miller, 2004).

2.10 Low Doses of IR and Reliability of Risk:

The committee of Biological Effects of Ionizing Radiation (BEIR) defined the low dose of IR as those doses that are less than 100 mSv. At low doses, the risk is not fairly clear but at higher doses the risk is evident. About 56% from Hiroshima and Nagasaki atomic bombs survivors were exposed to low level of IR (NRC, 2006). Based mainly on analytical statistics from studies on survivors, a linear non threshold (LNT) model was constructed. It supposes that the risk from IR increases by increasing the dose and there is no level below it the risk does not exist. Another model supposes that the risk does not exist until a certain level. (Health Physics Society, 2001)

Pollycove reviewed many studies on the effect of low IR. He refused the LNT and indicated that low doses has no effect on humans (Pollycove ,ND). In contrast Brenner et al reviewed many studies and concluded that there is no safe level of IR exposure and there is an epidemiological evidence for an increasing cancer risk at low doses; about 10-50 mSv for acute doses and 50-100 mSv for accumulative doses (Brenner et al, 2003). The risk increase of childhood cancer is statistically significant after the exposure of the fetus to about 10 mSv (Roll and Wakeford, 1997)

Other studies concluded that the LNT models are overestimating the risk (Cohen, 2000), while another concluded that they underestimated the risk (Dropkin, 2007)

The Biological Effects of Ionizing Radiation committee (NRC, 2006) and the United Nations Scientific Committee on the Effect of Atomic Radiation reviewed numerous numbers of studies on the effect of low IR and concluded that the risk of cancer increases with increasing the dose and there is no threshold to induce it (UNSCEAR, 2000). The ICRP also adopt this model based on cellular studies (ICRP,ND).

2.11 Decreasing Radiation Exposure from Diagnostic Medical Radiation

Today's physicians are getting their diagnoses mainly by doing IR examinations where it can be taken by clinical examinations (Golding and Shrimpton, 2002), or by talking patient's clinical history, since the patients rely on these examinations and feel better with high technology ones (Picano, 2004).

It is noticeable that there is a significant number of IR examinations that do not affect the patient's clinical management and expose them to unnecessary dose of radiation. The experts of Radiology in the European Commission have related this to six main causes: (1) there is no care to get a previous film, so repeat the examination, (2) requesting a wrong imaging because of lack of communication with a radiologist, (3) there is no need to do the investigation either because the result will not affect the clinical management or (4) it is clinically early to investigate, (5) not providing a clinical information which is required for imaging the suitable one and finally (6) most of physicians rely on imaging and the patients feeling comfortable when being imaged (EC, 2000-B).

To reduce the exposure from medical IR, there are two bases of radiation protection that should be taken into consideration. One of them is related to technical factor and protective measures and the second, which is in some way related to physicians, is the medical justification (ICRP,1991). Justification means that using IR examination should have a benefit greater than the risk, taking into account the alternative imaging which does not use IR (ICRP,1991). The benefit means that the result from doing such examination will alter positively the health care management (Golding and Shrimpton, 2002).

The referring physicians should justify the IR examination by weighing the benefit versus the risk from doing it before referring the patients. So they should know the risks from medical IR (EC,2000-A) since the risk varies according to dose and exposure time. Knowing the doses received by the patients will aid physicians in risk assessment for each examination (Frasher and Allizer, 2006). Knowing that IR examination can cause cancer as in abdomen CT, the relative risk, may get physicians attention for well justification (CSAPH, 2006).

Amis et al, 2007, indicate that some referring physicians know about IR exposure and safety issues and take it into consideration in their medical decisions, while others who have a little or no information, do not consider the risk in their imaging decisions.

Picanno E. suggests many points to reinforce the European Law. By using penalty point for each inappropriate examination. By giving a radiology prescribing license, and if there are a high number of inappropriate examinations, the doctor will forced to attend a radiology course and if he continues, the license will be withdrawn. The other method is the patient informed consent. This form contains demonstrating the type of examination and the dose in mSv and the equivalent dose in chest x-ray and the risk of cancer and other risks. So the doctor will be informed in order to inform the patient and he will know the risk and the benefits from what he would be doing.(Picano, 2004)

Lee et al surveyed the knowledge of emergency department physicians in U.S. academic medical center about the radiation risks from CT, and they found that just 9% of the physicians believed that CT increases the lifetime risk of cancer and about 75% of them underestimate the dose from chest CT in chest x-ray equivalent (Lee et al, 2004). Another study in Israel indicates that most orthopedists underestimated the lifetime risk of cancer from a bone scan (Finestone, 2003). In contrast, most of physicians reported that they have knowledge about medical IR risks that they can cause cancer and genetic effects. But most of the physicians did not know that the exposure to natural IR may be equal to some IR examinations (Rassion et al, 2005).

Knowledge of physicians about exposure from medical IR is that it seems to be low according to many studies in different countries. A questionnaire study was done on a convenient sample from two hospitals in UK to investigate the physicians knowledge regarding IR doses received by patients from chest x-ray in mSv and from other medical IR examinations in chest x-ray equivalent. None of them know the dose received by patients from chest x-ray. About 97% of the physicians underestimated the doses from various IR examinations, while 5% of them claimed that ultrasound uses IR and 7% claimed that MRI uses IR (Shiralkar et al, 2003).

Another study in Germany at a university hospital was done on non-radiologist physicians. This study aimed to assess the knowledge of non-radiologist physicians regarding exposure from thorax IR examinations. About 39.5% from them correctly estimated the dose from chest x-ray and lower percent of about 33.6% correctly estimated adult chest CT exposure in chest x-ray equivalent. Also about 26.1% and 26.9% of the physicians correctly estimated the dose from cardiac CT and pediatric chest CT respectively in chest x-ray equivalent (Heyer et al, 2007). The experience years , field of clinical training and hierarchical positions do not affect these results (Heyer et al, 2007).

In Turkey, a study conducted on physicians from three university hospitals in addition to other medical institutions and three clinics. They asked the physicians to estimate the dose received from doing a radiological examination in chest x-ray equivalent. About 93% of them underestimated the patient doses. While 4 % and 27.4% of them claimed that abdomen ultrasound and abdomen MRI respectively exposed patient to IR (Arslanoglu et al, 2007).

In Northern Ireland, another survey study conducted on health care professionals to assess their knowledge about radiation dose and risk where a large sample selected randomly. They were asked about the doses from chest x-ray and from natural background and to estimate doses and risks from various medical IR examinations. About 39% of them achieved mean of scores of about 7.1 out of 18, 26% of them scored about 9 or more while just 20% knew the chest x-ray dose. This study demonstrates also that physicians who received formal training about IR issues are more knowledgeable than those who did not (Soye et al, 2008).

In another specialized study to assess the pediatricians' awareness regarding IR, only 6% of them correctly had estimated the excess lifetime risk from pediatric CT. About 87% and 94% of them underestimated the dose in chest x-ray equivalent from various radiological examinations and CT examinations respectively. Also about 15% of the pediatricians were familiar with ALARA principle, and only 14% of them reported that they received any relevant formal education during their training (Thomas et al, 2006).

Another survey was conducted to assess the attitude of various specialist physicians about risk and benefit from chest CT. While 64% of them believe that chest CT give new information, more than 90% of them underestimate or did not know the dose from chest CT in chest X-ray equivalent(Renston et al,1996).

In order to help physicians to avoid unnecessary examinations and unnecessary exposure, the American College of Radiologist (ACR) puts appropriateness criteria for IR examinations (ACR, 2007). Also the Royal Australian and New Zealand College of Radiologists put imaging guidelines (Royal Australian and New Zealand Collage 2001 sited in Diakie Fitechew, 2004). The European Commission also issued a booklet named Referral Guidelines for Imaging. It demonstrates the appropriate examination for clinical situation and imaging techniques including exposure, and also provides information about classification of cancer risk from IR examinations. (EC, 2000-B).

EC imaging guideline indicates that the referral physicians should give a sufficient clinical data, and the reasons for requesting it to be clear for a radiologist and radio-technologist. The radiologist, from this information, may see an alternative examination to do for the case to reduce exposure. If the referring physician is in doubt about making IR examination, he should communicate with a radiologist to know the best investigations

(EC, 2000-B). The referring physician should communicate with a radiologist to determine if there is a necessity to follow up by using IR examination (Kalra et al, 2004).

More attention should be taken by physicians when requesting a high diagnostic dose examination like CT, especially when the patient is a child (FDA, 2001). The pediatrician should take more caution in children CT imaging and should put an emphasis on reducing the exposure by counseling a radiologist (Slovis, 2003).

Regarding interventional radiology and using fluoroscopy which is considered of higher dose than conventional x-ray. The personnel and physicians who do it should be trained to keep the exposure as low as reasonably achievable (ICRP, ND).

The FDA also recommends the necessity of training all the operator and physicians who make an intervention under fluoroscopy for their patients on radiation protection and how to reduce the dose. Also they should be educated on making risk benefits assessment for case by case. The necessity to counsel the patients regarding the risks from such large radiation exposures through consent forms (FDA, 1994).

Non-radiologist physicians, who ask for a medical exposure either by sending patient to radiology department or they perform it under fluoroscopy, should receive a radiation protection training to be able to make justification and optimize the exposure as low as reasonably achievable (ALARA principle) (EC , 2000-A)

Reducing the dose to children after justification from a referring physician could be done by optimizing the exposure (using a suitable technical factor, as low as achievable) (ICRP, ND).

Concerning women in reproductive age, the physician should take information about the pregnancy status and if they are likely to be pregnant they should avoid abdomen pelvis x-ray unless there is strong indication (ICRP, 1991).

There are many strategies that can be followed to reduce the risk to the pregnant women, since the risk is cumulative as radiological exposure. Justification, physicians weighing of the benefit versus the risk is necessary to positively affect the health management of the mother with indirect benefit to the fetus. Avoidance strategy is the avoidance of any IR examination which does not influence the patient's care such as those taken routinely. Delay strategy: if the suspected result does not alter medical management immediately, it should be delayed particularly in the most sensitive period of pregnancy. Delaying IR examination (unergent radiograph) should be taken upon justification of risk and benefit for both the fetus and mother. Alternative strategy: if the IR examination can be substituted by a non IR examination as U/S and MRI which have no risk to the fetus(Diagnostic ionizing radiation and pregnancy: is there a concern?,2008).

Regarding knowledge of teratogenic risk associated with abdomen x-ray and abdomen CT during early pregnancy, a study was conducted to estimate this perception among family and obstetric physicians selected randomly across Ontario, Canada. The result shows that those physicians have a high unrealistic perception about teratogenic risk associated with abdomen x-ray and abdomen CT. The authors have shown that this misperception could lead to a delay in health care of a pregnant woman (Ratnapalan et al, 2004).

2.12 Physicians Education about IR issues:

The National Action Plan on Breast Cancer (NAPBC) recommends the education of physicians about IR issues, benefits, risks, effects of single and cumulative doses, and knowledge of received doses. It emphasizes the IR exposure education in order to reduce risk of cancer breast. Moreover, it recommends educating the consumer about these issues.

> It stated that "education of medical personnel and consumer is a critical foundation for prevention effects"(Balaban et al ,1997).

Physicians should be educated about the risks and examinations to be able to request the imaging and justifying it (Aims et al, 2007). What's more, they will be able to communicate and counsel the patients about the risks and benefits from doing IR examinations (CASPH, 2006).

In fact, there are numbers of articles talking about medical IR issues in order to educate or increase physicians' awareness about it. CSAPH wrote a report about this subject (CSAPH, 2006), pediatrics journal also provides articles about it (Frush et al, 2003, Solvis, 2003, Brody et al, 2007). ICRP also provides a guide for medical practitioners talking about medical IR issues (ICRP,ND),

Communication between the radiologist and referral physicians is a way of education for a referral physicians and result in decreasing unnecessary exposures and examinations (Frush et al,2003, Solvis,2003)

Another educational method is across web site. Health Physicists Society web provides radiology information which is directed to physicians. In addition, FDA web provides that information too.

Quinn et al studied the awareness in non-radiologists where some of them were attended a radiation protection course. No differences were shown between attended and not attended regarding IR risks. All of them underestimate the radiation risks from X-ray procedures. The majority of them did not recognize ALARA principle nor annual dose limit for patients. He referred that to poor attendance because of competing clinical courses, so he suggested to introduce radiation protection in medical school as a compulsory course (Quinn et al ,1997).

Medical education through school seems weak regarding IR issues according to the result from some studies. A study was conducted on medical students of Birjand University of Medical Science in Iran; the mean knowledge was 10.13 for internal students and 9.07 for clerkship student from 20 items. These results indicate that the knowledge of student is not enough (Tavakoli et al, 2003). Another study was conducted on medical students of private medical college of Karachi in Pakistan. This study was made to investigate the students' knowledge about ionizing and non ionizing radiation and show that most of students have a limited knowledge regarding radiation sources, risks, and protection (Mubeen et al, 2008).
Aims et al indicated the necessity to educate the physicians during medical school study about IR issues and exposures to patients, and should be also reinforced during residency's post graduated years (Aims et al, 2007).

Chapter Three

Methodology

Chapter 3

Methodology

In this chapter, the methodology used in this research including the design of the study, sampling process, setting of the study, study instrument, data collection and the analysis will be reviewed. Moreover, ethical considerations was taken into consideration through conducting the research. Finally, the obstacles and limitations which faced the researcher through conducting the research are also mentioned.

3.1 Study Design

The design of this study was a quantitative analytical descriptive study (cross-sectional study). It has been selected because it is useful for the descriptive type of studies. The cross-sectional study assesses the dependent variables and independent variables at the same time, and it is a simple and short. Also it is an analytical inasmuch as comparing between groups (Yale University, School of Medicine,2007).

The dependent variables in this study included knowledge and practices, while the independent variables included socio-demographic factors such as: age, education and hospitals; and work related factors such as: specialty degree, department type, experience years, experience status inside radiology department and using x-ray status.

3.2 Study Population

The target population of this study was the physicians who have been working in three governmental hospitals in Gaza Governorates.

3.3 Eligibility criteria

3.3.1 Inclusion Criteria

All physicians who have been working in the three governmental hospitals in Gaza Governorates; Shifa, Nasser, and the European Gaza hospitals.

3.3.2 Exclusion Criteria

Radiologists were excluded from this study because of their knowledge about IR which is assumed to be of high level. If included, they might cause extremes values and higher mean than the actual. In addition, for fair comparison, dentists were excluded because they are not doctors of medicine (physicians), but they are doctors of dental medicine or of dental surgery.

3.4 Sample Size

The sample size was calculated by using sample size calculator from the survey system on the web, with confidence level of 95% and confidence interval of 5. The calculated sample size was 256 of the 766 physicians working at the three hospitals (Annex 2). The researcher decided to increase this number to 300 in order to increase the response rate and to compensate for the uncertainties.

3.5 Sampling Process

A list of physicians and their departments was obtained from the administration of each hospital. A proportionally stratified sample was taken from each hospital (Table 3.1); 167

from Shifa hospital, 75 from Nasser hospital and 58 from the European Gaza hospital physicians.

Table 3.1: Sample Distribution according to Hospitals' Physicians Population and Percentages

Hospital Name	population		Sample Size	
	N	%	N	%
Shifa	421	55.7	167	55.7
Nasser	189	25	75	25
EGH	146	19.3	58	19.3
Total	756	100	300	100

Another proportional stratum was made for each hospital.. The physicians were stratified according to the main departments; surgery, internal medicine, pediatrics (including surgical pediatrics) and obstetrics. Table(3.2) demonstrates these proportionalities.

Table 3.2: Sample Distribution according to Main Departments

Department / Hospital	Surgery		Internal Medicine		Pediatrics and Surgery Pediatrics		Obstetrics		Total	
	N	%	N	%	N	%	N	%	N	%
Shifa	69	42.5	60	36	13	7.5	25	15	167	100
Nasser	23	30	26	35	14	18.5	12	16.5	75	100
EUG	28	48.5	17	29.5	13	22	-	-	58	100
Total	120		103		40		37		300	100

3.6 Setting of the Study

The study was done in Gaza governorates. Main three hospitals was selected, Shifa Hospital in Gaza city, Nasser Hospital in Khanyounis city, and European Gaza Hospital in Khanyounis governorates south border.

The hospitals were selected because of their large and divers of their radiological services.

3.7 Ethical Considerations

A written consent was obtained from the Helsinki committee at the ministry of health in August 2008(Annex 3), and an approval also was obtained from the ministry of health (Annex 4). A cover page was attached to each copy of the questionnaire to show the study purpose and objectives. Also some information was added about the institute of the research, name of the researcher, and the right of participations. The confidentiality was guaranteed and maintained since the questionnaire was anonymous (Annex 5).

3.8 Study Instrument

A self administered questionnaire was constructed in order to meet the objectives of the study. It was constructed after reviewing many literature on the subject. Originally it was constructed in English (Annex 6), and then translated into Arabic except some medical terms remained in English (Annex 7). The questionnaire was composed of three parts; the first part was for collecting socio-demographic personal data and work related factors. The second part was designed to measure the level of knowledge among physicians about IR and its risk, and it was composed of thirty questions. The third part was designed to measure the practice level and it consisted of twenty one questions; two of them were about the availability.

Knowledge questions were designed to measure four items; the first item was about IR identification, five questions (1 to5). The second item was about radiation protection, basically for physicians, and it was composed of three question (6 to 8). The third item was constructed to measure exposure knowledge, and it was composed of five questions (9 to 11, 28 and 30). The last item was designed to measure knowledge about risks of Medical Ionizing Radiation. It was the largest item and was composed of seventeen questions from 12 to 29 except question number 28.

3.8.1 Content Validity

The researcher had reviewed the available literature on sources and types of IR, the risks and exposures of IR specially in medical uses in order to reconstruct the questionnaire. After construction, the questionnaire was sent to many experts, accompanied with the objectives of the study, to check its validity in meeting these objectives. It had been sent to twelve experts but, only ten of them responded and sent their suggestions and comments. Three of those who responded are radiologists and the others are medical physicist, radiographer, professor of public health, toxicologist, health administrator doctor and a public health nurse (Annex 8). Their suggestions and comments had been taken into account, where some of the questionnaire items were changed, notified, added or excluded.

3.9 Pilot Study

A pilot study was conducted before data collection. It was used to check the ambiguity in the question statements and the time taken to complete the questionnaire (Teijlingen and Hundley, 2001). Thirty physicians were selected to participate in the pilot study; 12 from Shifa hospital, 10 from Nasser and 8 from EGH. They were selected by the convenience method, and they were excluded from the study sample to avoid prior test effects. A little modification in some expression statements were made after the pilot study. The questionnaire took 25-30 minutes to be filled.

3.10 Data Collection

The data were collected by the researcher and six assistants who were colleague radiographers; two colleagues from each hospital. Data collection had started on the 10th of February and continued until the 10th of May, 2009. The questionnaire was distributed to the physicians randomly according to their strata. A cover page that demonstrates the research title and the general objectives was attached.

Note: The assistants had received instructions to guide them in collecting the data. The objectives of the study and sampling procedure were explained to them**,** then each one was given a list of the selected physicians.

3.11 Response Rate

The response rate was 70%. Some of the physicians refused to answer the questionnaire because of the restriction of their work time.

3.12 Statistical Analysis

The data were entered and analyzed by using the statistical package for social science (SPSS, version 12). Data clearance was made to check any entry errors.

Socio-demographic factors and work related factors, which represent the independent variables, were described by descriptive analyses (frequencies and percentages). For the dependent variables, the knowledge and practice, descriptive statistics such as means and standard deviation were used.

To examine the relationship between the dependent and independent variables, the researcher use both the t-test and the one way analysis of variance (ANOVA). In addition to person's correlation coefficient to investigate the correlation between the IR knowledge and practice.

3.13 Limitations of the Study

1. The results can be only applied on the physicians of the three governmental hospitals included in the study.
2. The authenticity of the use of a self-administrated questionnaire depends on honesty and seriousness of the participants.
3. This study, according to the researcher's knowledge, is the first in Palestine, and even in the neighboring countries according to the web.
4. Little references was found about the study, but most of them talk about the exposure knowledge, little about the risk, and no one talked about the practice. those studies were concerned mostly by an item of exposure.
5. Too much time was taken to finish this research due to frequent changes of the supervisors, the late Israeli aggression on Gaza, and some personal circumstances.
6. The difficult political situation which is responsible for the long term on going physicians' strike.

Chapter Four

Results and Discussions

Chapter 4

Results and Discussions

In this chapter, the researcher will present the main results of the study based on the outcomes of the statistical analyses. The first part of the results includes the distribution of the participants according to their sociodemographic characteristics as age, sex, hospital and the education status. The second part of the results consists of frequencies and percents of work related factors for physicians as their specialty, experience years, practical experience in radiology department, department in which the physician works and courses received about IR. The third part of the results relates to the Physicians responses about the knowledge and practices items. Then the researcher determine the levels of knowledge and practices among Physicians regarding IR.

The researcher conducted one-way analysis of variance (ANOVA) and an independent sample t test to test the difference between the Knowledge and practices as dependent variables and the sociodemographic and work related factors as independent variables. Pearson's correlation was used to explain the relationship between the IR Knowledge and Practices among Participating Physicians

4.1 Results of Sociodemographic Data

The participants in this study were 210 physicians. The socio-demographic data were related to the participants' description by their frequency and percents in the study. Age, sex, place of work, and education data were obtained according to participants answers.

Most physicians' ages were 35 years and less, about 42% of the participants. Then they are followed by participants with age between 35 and 45 years (40.5%). The smallest category group among age groups was for those above 45 years of age (about 17.4%).This means that the physicians of the study are of the young population.

There is a wide variation in sex of physicians; there are 201 male participants with 95.7% compared to 9 female participants. This result reflects the community culture towards women.

There are three hospitals in this study with the large number of participants from Shifa hospital, about 99 participants, who account for 47.1%. Then it is followed by Nasser hospital with 29.5% and those in the European Gaza hospital account for 23.3%. This result is not a surprise since the sample was taken proportionally and the largest hospital is Shifa.

Most of participants with MBBH degree and they account for 42.3%, followed by participants with Master degree which represent about 39.4%. Participants with PhDs account for 11.5%, which is higher than those with postgraduate diploma (6.7%). The following table (4.1) summarizes the sociodemographic factors of physicians who participated in the study.

Table 4.1: Sociodemographic Data of the Participants: Age, Sex, Hospital and Education

Item	No.	%
Age		
Less than 35 Yrs	80	42.1
From 35 to 45 Yrs	77	40.5
More than 45 Yrs	33	17.4
Total	**190**	**100.0**
Sex		
Male	201	95.7
Female	9	4.3
Total	**210**	**100.0**
Hospital		
Shifa	99	47.173
Nasser	62	29.524
EGH	49	23.333
Total	**210**	**100.0**
Education Status		
MBBCH	88	42.31
Postgraduate diploma	14	6.73
Master	82	39.42
PhD	24	11.54
Total	**208**	**100.0**

4.2 Result of Work Related Factors

The work related factors for physicians in this study was their specialty, experience years, practical experience in radiology department, department in which the physician works and courses received about IR. These work related factors are described by their frequency and percent as shown in Table 4.2.

Table 4.2: Work Related Factors of Participating Physicians

Item	No.	%
Specialty		
Consultant	19	9.05
Specialist	108	51.43
General	83	39.52
Total	**210**	**100**
Experience		
5 Yrs and less	64	32.82
From 6 to 10 Yrs	73	37.44
More than 10 Yrs	58	29.74
Total	**195**	**100.0**
Experience in Radiology Department		
Yes	35	16.7
No	175	83.3
Total	**210**	**100.0**
Department		
Surgery	84	40.0
Internal Medicine	69	32.86
Pediatrics	31	14.76
Obstetrics	26	12.38
Total	**210**	**100.0**
Training Status in Radiology Department		
Yes	10	4.8
No	200	95.2
Total	**210**	**100.0**
Using X-Ray in Interventional Practices		
Yes	64	30.5
No	146	69.5
Total	**210**	**100**

From the above table, it is shown that specialized physicians are the highest among the physicians with a percentage of about 51.4%, followed by general physicians with 39.5%, and the consultants represent about 9%. This means that most of the physicians who had participated in this study are specialized.

According to years of experience the study population was categorized into three groups; the physicians who have five years and less were about 32.8% and those with experience years from 6 to 10 represent about 37.4% of the sample. This indicates that there is homogeneity in the experience of the physicians and that there are no experience gabs between them. The least category was whose with experience years of more than 10 years (29.7%).

Concerning the physicians experience in the radiology department, the results show that only 16.7% have experience in the radiology department. This shows that most of the physicians have insufficient experience in radiology department.

According to the department in which the physician works, 40% of the participants work in surgery departments, while 32.9% in internal medicine departments. Those who work in pediatrics and pediatric surgery departments represent about 14.8%, and the least number works in the obstetrics departments (12.4%).

Just about 4.8% answered that they had received courses about IR which is a very low percent which indicates that there is little concerns regarding IR education among physicians. Regarding using x-ray in interventional practices, 30.5% of the physicians use it while the majority do not use.

4.3 Response of Participating Physicians to the Questionnaire Items

4.3.1 Response to Knowledge Items

The research was constructed of 30 questions to measure the knowledge about different items of the ionizing radiation subject.

Table 4.3: Responses of Participating Physicians to Knowledge Questions

1	Questions	True		False	
		No.	%	No.	%
1	Ionization is the removal of electrons from the atom	149	71.0	61	29.0
2	X-ray is a stream of electrons with high energy	110	52.4	100	47.6
3	Ionizing radiation sources are mainly man-made	111	52.9	99	47.1
4	Radon gas is a natural ionizing radiation source	105	50.0	105	50.0
5	Gamma rays and Beta particles are considered as ionizing radiation	131	62.4	79	37.6
6	Patient's physician plays a role in determining radiation dose to patients	166	79.0	44	21.0
7	The application of the first radiation protection principle (known as Justification Principle) is the responsibility of the treating physician	96	45.7	114	54.3
8	The highest percentage contribution of radiation exposure to the population from man-made sources is from diagnostic x-ray procedure	110	52.4	100	47.6
	Most of plain films have lower patient doses than fluoroscopy examinations.	119	56.7	91	43.3
	Barium enema examinations have lower patient doses than brain C.T.	99	47.1	111	52.9
11	All C.T examinations have lower patient doses than diagnostic nuclear medicine investigations.	106	50.5	104	49.5
12	Cardiovascular diseases may be induced after an exposure to high therapeutic doses of ionizing radiation	107	51.0	103	49.0
13	Skin injuries may be induced as a result of exposure to prolonged interventional fluoroscopy examination (cardiac catheter ablation, percutaneous trans-hepatic cholangiography)	125	59.5	85	40.5
14	Teratogenic effects need a certain level of ionizing radiation below which does not occur	90	42.9	120	57.1
15	Skin injuries may be induced post exposure to C.T examination	129	61.4	81	38.6
16	Exposure to ionizing radiation from diagnostic x-ray procedures has the probability to induce genetic effects.	129	61.4	81	38.6
17	Fertility impairment need a certain level of ionizing radiation below which does not occur	136	64.8	74	35.2
18	At the same age, male and female patients are at the same degree of risk when exposed to ionizing radiation	102	48.6	108	51.4
19	Nerve cells are more radiosensitive to ionizing radiation than bone marrow	111	52.9	99	47.1
20	Thyroid gland is more radiosensitive to radiation than the kidney	168	80.0	42	20.0
21	The risk for radiation is the same for all ages	144	68.6	66	31.4
22	Exposure to radiation- such as radiotherapy- may lead to erythryma and hair loss	164	78.1	46	21.9
23	Exposing patients to medical diagnostic imaging tests (using ionizing radiation) increases lifetime risk of cancer	151	71.9	59	28. 1
24	Exposing patients to medical diagnostic imaging tests (orbit C.T) increases the probability of inducing cataract	118	56.2	92	43.8
25	Exposure to one medical diagnostic imaging tests has the same probability of risk as being exposed to two tests separated by some time	135	64.3	75	35.7
26	Cataract may be induced as a result of radiotherapy exposure	101	48.1	109	51.9
27	The risk of malformation associated with abdominal radiography(abdomen x-ray) during organogenesis stage of pregnancy is higher than natural risk of malformation	49	23.3	161	76.7
28	MRI works by a low energy of ionizing radiation.	80	38.1	130	61.9
29	Exposing a pregnant woman to medical diagnostic ionizing radiation increases the risk of childhood cancer to her fetus	121	57.6	89	42.4
30	Do you know the dose in chest x-ray Equivalent of abdomen C.T.?	61	29.0	149	71.0

From the above table, the results are as follows. The first item talks about the identity of IR and consists of five questions. The percentage of participating physicians who know that ionization is a removal of electrons from the atom was about 71%. The rest either they said the opposite or they did not know, while those who know that Gamma rays and Beta particles are considered as IR were about 62.4%. Furthermore, the other three questions were about the participants' knowledge of the questions, the percentage was lower than 53%, which can be classified as a low level of knowledge.

Radiation protection item is the second one, and composed of three questions. They talked about the role of referral physicians and its importance. About 79% of the participating physicians know their role in determining the dose to their patients. This percent is acceptable, while for the other two questions the percent of true answers was less than 54%, which is considered low.

Regarding the exposure item which consists of five questions, the knowledge of participants was low. Surprisingly, it was just 38.1% of the participants who know that MRI does not use IR, and this very low percent seems inadequate. Only 29% from them knew abdomen CT in equivalent chest x-ray. It seems that the participating physicians' knowledge about patients IR exposures was low.

About the fourth item which consists of seventeen questions, participating physicians' knowledge was relatively high in few questions. Most of them knew that thyroid gland is more radiosensitive to radiation than the kidney with a percentage of about 80%. While only 20% of them answered the opposite or they did not know. Also the relatively high percent for knowledge was to the 22nd question which stated that, radiotherapy leads to erythryma and hair loss by 78.1%. This knowledge seems unsatisfactory because of the high risk. Only 71.9 % knew that diagnostic x-ray increases the lifetime risk of cancer, while 28.1% did not know that or said the opposite. Furthermore, this result is not satisfying because of the physician's responsibility to justify the request when the benefit surpasses the risk. A lower percent (57.6) of the participating physicians' knowledge about increasing lifetime risk of childhood cancer to the fetus when his mother is exposed to medical diagnostic IR was recorded. Also this percent is low because of the responsibility of physicians in counseling the patients. At the same age, female patients are at greater risk than male patients when exposed to IR. Just 48.6% of the participants knew this fact, which for physicians is a low knowledge as an important fact. The fact that the risk from IR is not the same for all ages was known by 68.6% of the participants, while 31.4% did not know this fact or answered the opposite.

The lowest knowledge for the twenty-seven questions was of the seventeenth. Just 23.3% of the participants, knew that the risk of malformation in the organogenesis stage of the pregnancy was lower than the natural risk of malformation. This percent was very low, while due to the importance of knowledge of this fact it should be high. The high knowledge helps the physicians to counsel the pregnant women in order to treat the pregnant patient without delay if it is a suitable procedure. All of the other questions had true answers with less than 65% of the participating physicians. This indicates that physicians' knowledge also was low.

4.3.2 Responses of Participating Physicians to Practice Items

The third part of the questionnaire contained practices questions. The nineteen questions were constructed to measure the practice of the participants, in addition to two questions about availability. Of the 30.5% who use x-ray, just about 56.3% follow the practical radiation protection principle – as low use as reasonably achievable, while 31.3% do not know this principle and 12.55% do not follow this principle. The principle is very important to protect the patient and reduce the risk of IR as possible. So the physicians who use x-ray in interventional practices should follow this principle. Half of the participants follow the principle, but this is not enough and indicates negative practice toward IR protection. Participating physicians were also asked about the availability of imaging protocols. About 81.9% of the participating physicians indicated that there was no imaging protocols, while about 18.1% answered that there were imaging protocols, and most of them (91.7%) follow these guidelines. All of the participants have been working in governmental hospitals. This variation in answers about the availability of guidelines indicates that either the participants have no knowledge about its availability or it is not existent. Table 4.4. summarizes these results.

Table 4.4: Participating Physicians Following ALARA Principle and Imaging protocols

Item	No.	%
Following ALARA principle		
Yes	36	56.3
No	8	12.5
DK	20	31.3
Total	**64**	**100.0**
Following imaging guidelines		
Yes	33	91.7
No	3	8.3
Total	**36**	**100.0**

Regarding responses to other practices items, a high percentage on two questions was reported. Firstly, 90% said that they asked female patients about pregnancy, while 10% either they sometimes or did not ask about pregnancy. Secondly, a high percentage (94%) reported that they have been notified about pregnancy on radiology examination while 6% answered sometimes or they did not respond. Regarding the consultation with radiologist about the effective radiological procedure for patients, 73% of the participating physicians said they made consultation with radiologist frequently or sometimes. While 27% said that they did not make consultation with radiologist. The participants who recorded diagnosis and patient history on radiology request represent 69.5%, while just 30.5% either sometimes they record or did not record at all. Regarding recording a radiological examination, the results show that 65.7% said that they do this mostly and 33.3% sometimes they do or did not do it at all. The participating physicians also recorded two very low percentages; just about 44.8% from them mostly took into account the ten day rule when requesting a radiological examination for a woman in reproduction age, while the 45.2% either sometimes or not at all took the rule into account. The second low percent was about counseling the patients regarding the risk and benefit from radiological examination where 42.4% did this mostly well and 57.6% did not do this at all or sometimes they did.

Regarding the rest of the practices, the positive practice of the participants was less than 66%. The following table (4.5.) shows these results.

Table 4.5: Responses of Participating Physicians to Practices Questions

	Questions	+Ve practice		-Ve practices	
		No.	%	No.	%
1	Do you follow a certain criterion in requesting multiple radiological examinations? For example degradation	140	66.7	70	33.3
2	Do you ask patients about previous exposures to ionizing radiation? (How many and when)	132	62.9	78	37.1
3	Do you see the result of the previous radiological examinations before requesting another one?	130	61.9	80	38.1
4	Do you record a diagnosis and patient history on the ionizing radiation requests?	146	69.5	64	30.5
5	If you request an x-ray examination or C.T for women in reproductive age, do you ask her about pregnancy?	189	90.0	21	10.0
6	Do you take into account a ten day rule (Ten day after menstruation) when requesting a radiological examination?	94	44.8	116	55.2
7	Do you make a consultation regarding the doses received by patients?	124	59.0	86	41.0
8	Do you consult with a radiologist to know the most effective radiological procedure regarding the clinical case of your patient?	154	73.3	56	26.7
9	Do you consult with a radiologist or a radiographer about exposure risk?	126	60.0	84	40.0
10	Do you counsel the patients regarding the risks and benefits of ionizing radiation examination?	89	42.4	121	57.6
11	Do you record radiological examination on patients file and the result of it?	138	65.7	72	34.3
12	Do you request chest x-ray as routine for inpatients?	120	57.1	90	42.9
13	Do you request x-ray examinations as patient desire for psychological purposes?	110	52.4	100	47.6
14	If you need a biopsy procedure, do you request it under C.T.?	90	42.9	120	57.1
15	In case of patient pregnancy, do you notify about her pregnancy on the patient request?	199	94.8	11	5.3
16	Do you delay a radiological examination (abdomen and pelvis x-ray) for a pregnant woman?	116	52.4	100	47.6
17	Do you request C.T. examinations just for doing something to the patients?	117	55.7	93	44.3

4.4 Levels of IR Knowledge and Practices among Physicians

Thirty questions were constructed to reflect the level of IR knowledge among physicians in three governmental hospitals in Gaza governorates in addition to the twenty one questions about their practices toward IR. For the knowledge questions each correct answer was scored by 1 and wrong answer by zero. Regarding practices questions, the positive practice was scored by one and zero for a negative practice.

To determine the level of the physicians' knowledge and practices, descriptive statistics was conducted such as mean, standard deviation and percentage. Table 4.6 summarizes these statistics.

Table 4.6: IR Knowledge and Practices among Physicians

Item	N	Number of Questions	Mean	Standard Deviation	%
IR Knowledge	210	30	16.77	3.78	55.92
IR Practices	210	19	11	2.98	57.89

The above table shows that the mean of scores was about 16.77 from 30 points regarding IR knowledge with a standard deviation of 3.78 and a percentage of 55.92%. This result indicates that the level of knowledge among physicians regarding IR and its risk was relatively low.

Regarding practices of the participating physicians toward IR and risk, from the table, the mean of scores which reflect positive practice was 11 from 19 points with a standard deviation of 2.98 and percentage of 57.91%. This result also indicates that there are relatively low practices among participating physicians. The practices of physicians regarding IR were covered by little researches according to the researcher knowledge.

Lee et al in 2004 found that, only 22% of the emergency department physicians communicate about risk and benefit from CT with patients, and only 9% mention the doses to their patients. While only one third of pediatricians communicate with the parents of the patients regarding radiation doses from CT examination.

4.4.1 Categories of IR Knowledge and Practice Levels

In spite of relatively low knowledge and practices about IR and its risks among participating physicians, the researcher classified them into three categories after knowing the mean of knowledge, and the mean of practice. The first category was less than 50% for knowledge and practices which represent low knowledge and low practice; the second category was from 50% to less than 70% which was medium knowledge and medium practices, while the high knowledge and practices were 70% and higher. Table 4.7 shows the frequency and percent of each category.

Table 4.7: Categories of IR Knowledge and Practice among Participating Physicians Levels

Item	No.	%
Knowledge		
Low	49	23.33
Medium	131	62.38
High	30	14.29
Total	**210**	**100.0**
Practices		
Low	67	31.9
Medium	92	43.8
High	51	24.3
Total	**210**	**100.0**

From the above table, the low knowledge category of physicians about IR and its risk was about 23.3%, while the medium knowledge was about 62.4% and high knowledge was about 14.3%. There is a wide variation in the knowledge categories. This result indicates that most of the physicians knowledge falls in the medium knowledge category, then low category, and the least physicians' knowledge was in the high knowledge category. This reflects the relatively low knowledge of the participating physicians.

Regarding practices of physicians toward IR and its risk, low practices category represents 31.9%, while the medium category was 43.8% and the high category about 24.3%. There are relatively large variations among categories but this is not as that in knowledge (figure 4.1). The result indicates that most of the participating physicians have medium practices, (43.8% of total participants), followed by those with low practices and the least was to those with high practices. The participants who have got a high practice represent only one fourth of the participants. This indicates relatively low practices.

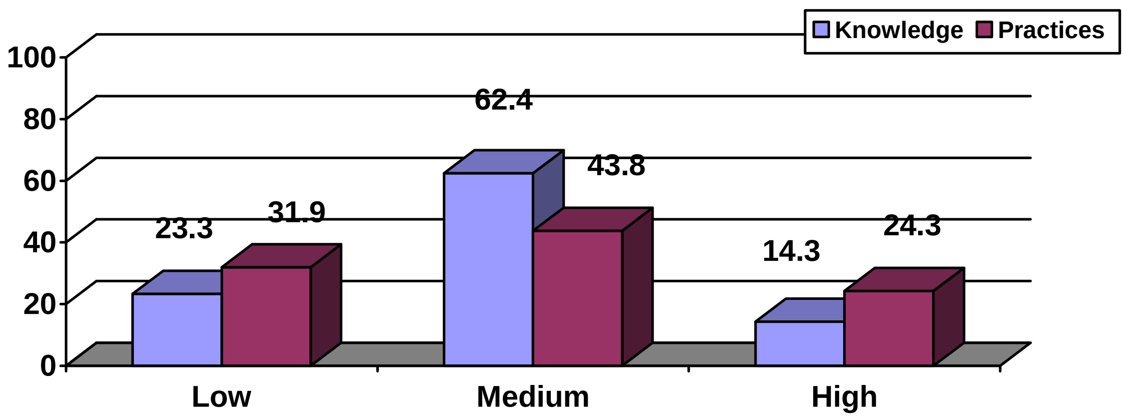

Figure 4.1: Categories of Participating Physicians Knowledge and Practices

4.4.2 Level of Knowledge about Different IR Items

As mentioned previously, knowledge questions were divided into four items concerning IR and its risks. The first item consists of five questions on identity of IR. The second is composed of three questions on radiation protection related to the referral physicians. The third one was on radiation protection, but it was specific for exposures from diagnostic radiological examinations and consists of five questions. The important item was about the risks of IR and consisted of seventeen questions.

Table 4.8: Level of Knowledge about Different Ionizing Radiation Items among Participating Physicians

Item	No. of questions	Mean	Std
Identity of Ionizing Radiation	5	0.6	0.2
Radiation Protection	3	0.6	0.3
Exposure	5	0.4	0.2
Risk	17	0.6	0.2
Knowledge	30	0.6	0.1

To make comparisons among knowledge items easily, the mean of each item was divided on the number of questions. From the table above, it is clear that the knowledge of physicians about different items is similar with no clear variation. Means of IR identity item, radiation protection and risk are alike of about 0.6 with a percentage of 60%. This indicates a relatively low knowledge. While the mean of exposure items of 0.4 was the least with a percentage of 40%, and it is considered as a low knowledge. This means that participants' knowledge about IR identity item, radiation protection and IR risks was higher than radiation exposure item. In spite of that, the participating physicians' knowledge about different items was low.

Regarding the results of exposure knowledge, they are similar to many studies conducted in different countries. According to these studies, most of the physicians did not know the actual dose of common radiological procedure in chest x-ray equivalent. Furthermore, they underestimated the dose (Soye J. et al, 2008, Atilla, et al, 2007, Thomas, et al, 2006, Quinn, 1997, and Shiralkar, et al, 2003). Low knowledge of physicians regarding CT doses in chest x-ray equivalent was concluded by other researchers (Lee, 2004, Ronston, 1996, and Heyer, et al, 2007). In addition, most of the physicians did not know that radiation doses received by various x-ray procedures or CT scans may be equal to natural background radiation (Russion, et al, 2005) . These results may be due to a defect in medical education, which does not cover these issues (Musbeen, et al, 2008, Tovakoli, 2003). The researchers of those studies conducted them on medical students in Pakistan and Iran. Also, most of pediatricians did not receive formal teaching during their specialty training (Thomas, et al, 2006). Furthermore, some physicians said that MRI and US expose the patients to IR according to many studies conducted in different countries (Atilla, et al, 2007, Heyer, et al, 2007, and Shiralkar, et al, 2003).

According to risk of IR Knowledge studies, there are underestimation of risk due to common radiological procedures (Quinn, 1997, and Thomas, et al, 2006). A little of physicians believed that CT increases the lifetime risk of cancer (Lee, et al, 2004). Soye, et al in 2008 concluded in their study that the physicians' knowledge about the potential risk from common radiological examination is poor. A study conducted to know awareness of physicians about bone scan risk indicated that most physicians underestimate the risk from bone scan (Fine, et al, 2003).

Another specific study indicated that family physicians and obstetricians overestimated the teratogenic effects which result from abdominal x-ray and CT during early pregnancy (Rantnoplan, et al, 2004). The different result was for Rassion, et al in 2005 who indicated that most physicians know that x-ray and CT can cause cancer and genetic effects. Most of medical students had a poor knowledge of radiological procedures risks (Mubeen, et al, 2008, and Tavakoli, et al, 2003).

Awareness of radiation protection issues is low among physicians according to Thomas, et al in 2006 and Quinn, in 1997. The medical students' knowledge about radiation protection is not adequate in two studies conducted by Mubeen, et al in 2008 and Tovakoli, et al in 2003.

4.5 IR Knowledge and Practices with Socio-Demographic Characteristics

4.5.1 IR Knowledge and Practices with Age Groups

The physicians who participated in this study were categorized into three groups regarding their age as mentioned previously. The first group represents the physicians with age of 35 years and less, the second of those from 36 to 45 years and the last group for whose of more than 45 years. To test the relationships among physicians' age groups with their knowledge and practices regarding IR and its risk, one-way ANOVA test was used. Other descriptive tests such as frequency, mean and standard deviation were also conducted. The following table (4.9.) shows the result.

Table 4.9: Participating Physicians Knowledge and Practices in Relation to Their Age Group

Item	Age	No.	Mean	Std	F	Sig.
Identity of Ionizing Radiation	35 Yrs and less	80	0.6	0.2	0.506	0.603
	From 36 to 45	77	0.6	0.3		
	More than 45 Yrs	33	0.6	0.3		
	Total	**190**	**0.6**	**0.2**		
Radiation Protection	35 Yrs and less	80	0.6	0.3	0.848	0.430
	From 36 to 45	77	0.6	0.3		
	More than 45 Yrs	33	0.6	0.3		
	Total	**190**	**0.6**	**0.3**		
Exposure	35 Yrs and less	80	0.5	0.2	0.635	0.531
	From 36 to 45	77	0.4	0.2		
	More than 45 Yrs	33	0.4	0.2		
	Total	**190**	**0.4**	**0.2**		
Risk	35 Yrs and less	80	0.6	0.1	1.982	0.141
	From 36 to 45	77	0.6	0.2		
	More than 45 Yrs	33	0.6	0.1		
	Total	**190**	**0.6**	**0.1**		
Knowledge	35 Yrs and less	80	0.6	0.1	0.739	0.479
	From 36 to 45	77	0.6	0.1		
	More than 45 Yrs	33	0.6	0.1		
	Total	**190**	**0.6**	**0.1**		
Practices	35 Yrs and less	80	0.6	0.2	0.889	0.409
	From 36 to 45	77	0.6	0.2		
	More than 45 Yrs	33	0.5	0.2		
	Total	**190**	**0.6**	**0.2**		

The above table shows that there is no variation of means of knowledge among the three age groups. There is no statistically significant difference between knowledge and age group (F = 0.739, P value = 0.479).

Regarding the exposure item, it is clear that the age group with 35 years and less has higher mean (0.5) than the other age groups of mean of 0.4. This means that they have higher knowledge than the other age groups, but there is no statistically significant difference between age groups and the exposure knowledge item. About other knowledge items, also there are no statistically significant differences (p-value >0.05). In spite of that, the mean of practice of the age group of more than 45 years was 0.5 which is less than the other groups (0.6). Moreover, there is no statistically significant difference among age groups and practices of participating physicians (F = 0.889, p-value = 0.409),

4.5.2 IR Knowledge and Practices with Hospitals

This study was conducted in three governmental hospitals; Shifa hospital, Nasser hospital and European Gaza hospital. To test the relationship between knowledge and practices of physicians with hospitals, one-way ANOVA test was conducted. Also other descriptive statistics such as means and standard deviation were calculated. The following table shows the results of these tests.

Table 4.10: IR Knowledge and Practices of the Participating Physicians in Relation to Hospitals

Item	Hospital	No.	Mean	Std	F	Sig.
Identity of Ionizing Radiation	Shifa	99	0.6	0.2	1.160	0.315
	Nasser	62	0.6	0.2		
	EGH	49	0.5	0.3		
	Total	**210**	**0.6**	**0.2**		
Radiation Protection	Shifa	99	0.6	0.3	2.585	0.078
	Nasser	62	0.7	0.2		
	EGH	49	0.6	0.3		
	Total	**210**	**0.6**	**0.3**		
Exposure	Shifa	99	0.4	0.2	0.962	0.384
	Nasser	62	0.5	0.2		
	EGH	49	0.5	0.2		
	Total	**210**	**0.4**	**0.2**		
Risk	Shifa	99	0.6	0.2	1.938	0.147
	Nasser	62	0.6	0.1		
	EGH	49	0.6	0.2		
	Total	**210**	**0.6**	**0.2**		
Knowledge	Shifa	99	0.5	0.1	1.705	0.184
	Nasser	62	0.6	0.1		
	EGH	49	0.6	0.1		
	Total	**210**	**0.6**	**0.1**		
Practices	Shifa	99	0.6	0.2	0.648.	0.524
	Nasser	62	0.6	0.1		
	EGH	49	0.6	0.2		
	Total	**210**	**0.6**	**0.2**		

From the above table, there are no statistically significant differences between physicians knowledge and hospitals (F = 1.7, p-value = 0.18). Mean results indicate that the physicians working at Shifa hospital have the lowest knowledge, and that the knowledge items with hospitals have no statistically significant differences. There is no statistically significant differences among physicians practices due to hospitals (F= 0.46, p-value = 0.52)

4.5.3 IR Knowledge and Practices of Physicians and Their Education

Education of the participating physicians was classified into four groups. First group was those with MBBCH degree, the second with postgraduate Diploma, the third masters Master and the fourth one was those with a PhD degree. The education status is the independent variable, to test its relation with the independent variables (knowledge and practices) one way analysis of variance was conducted, and other descriptive statistical calculations were done. Table 4.11 shows the results.

Table 4.11: IR Knowledge and Practices of Physicians and Their Education

Item	Education	No.	Mean	Std	F	Sig.
Identity of Ionizing Radiation	MBBCH	88	0.6	0.2	0.408	0.748
	Postgraduate	14	0.6	0.3		
	Master	82	0.6	0.3		
	PhD	24	0.6	0.3		
	Total	**208**	**0.6**	**0.2**		
Radiation Protection	MBBCH	88	0.6	0.3	4.056	0.008
	Postgraduate	14	0.4	0.2		
	Master	82	0.6	0.3		
	PhD	24	0.7	0.2		
	Total	**208**	**0.6**	**0.3**		
Exposure	MBBCH	88	0.5	0.2	0.350	0.789
	Postgraduate	14	0.5	0.2		
	Master	82	0.4	0.2		
	PhD	24	0.5	0.2		
	Total	**208**	**0.4**	**0.2**		
Risk	MBBCH	88	0.6	0.2	2.076	0.105
	Postgraduate	14	0.6	0.1		
	Master	82	0.6	0.2		
	PhD	24	0.6	0.1		
	Total	**208**	**0.6**	**0.1**		
Knowledge	MBBCH	88	0.5	0.1	1.808	0.147
	Postgraduate	14	0.5	0.1		
	Master	82	0.6	0.1		
	PhD	24	0.6	0.1		
	Total	**208**	**0.6**	**0.1**		
Practices	MBBCH	88	0.6	0.2	1.136	0.336
	Postgraduate	14	0.5	0.2		
	Master	82	0.6	0.1		
	PhD	24	0.6	0.2		
	Total	**208**	**0.6**	**0.2**		

The above table shows that there are no statistically significant differences between knowledge of the participating physicians and their education level (F= 1.808, p-value = 0.147), but there are statistically significant differences between radiation protection item and education level (F = 4.056, p-value = 0.008). According to Scheffe test the differences were for PhD with a mean of 0.7, followed by master and MBBCH with a mean of 0.6. The other knowledge items showed no statistically significant differences.

There is no statistically significant difference between physicians practices and education status (F = 1.136, p-value = 0.336). The researcher could not find any study that had investigated this relationship. Only one study had indicated that general physicians did not know that MRI does not expose patients to IR more than other specialized physicians and the difference was significant (Atilla, et al, 2007)

4.6 IR Knowledge and Practices of Physicians with Work Related Factor

4.6.1 IR Knowledge and Practices of Physicians with Hierarchical Specialty

Participating physicians hierarchical specialty was an independent variable in this study, and it was categorized into three groups; consultants, specialists and general practitioners. The mean, standard deviation, and one-way analysis of variance were calculated to see if the knowledge and practices of the physicians are related to the hierarchical specialty. The following table summarizes these results.

Table 4.12: IR Knowledge and Practices with Specialty Degree of Physicians

Item	Specialty	No.	Mean	Std	F	Sig.
Identity of Ionizing Radiation	Consultant	19	0.7	0.3	1.300	0.275
	Specialist	108	0.6	0.3		
	General	83	0.6	0.2		
	Total	**210**	0.6	**0.2**		
Radiation Protection	Consultant	19	0.7	0.2	2.788	0.045
	Specialist	108	0.6	0.3		
	General	83	0.6	0.3		
	Total	**210**	0.6	0.3		
Exposure	Consultant	19	0.5	0.2	0.636	0.530
	Specialist	108	0.4	0.2		
	General	83	0.4	0.2		
	Total	**210**	**0.4**	**0.2**		
Risk	Consultant	19	0.6	0.2	1.926	0.148
	Specialist	108	0.6	0.1		
	General	83	0.6	0.2		
	Total	**210**	0.6	**0.2**		
Knowledge	Consultant	19	0.6	0.1	2.249	0.108
	Specialist	108	0.6	0.1		
	General	83	0.5	0.1		
	Total	**210**	0.6	**0.1**		
Practices	Consultant	19	0.6	0.1	1.072	0.344
	Specialist	108	0.6	0.2		
	General	83	0.6	0.2		
	Total	**210**	**0.6**	**0.2**		

The above table shows that there is no statistically significant difference between knowledge of the participants and their hierarchical specialty, but there is a statistically significant difference between radiation protection item and the hierarchical specialty (F = 2.778, p-value = 0.045). The Scheffe test indicated that the difference is for consultant physicians with a mean of 0.7, followed by specialists and general physicians with a mean of 0.6. Regarding the other items there were no significant differences with specialty hierarchy. There are no statistically significant differences between practices of participant's physicians and hierarchical specialty (F = 1.072, p-value = 0.344). Regarding the knowledge and practices about IR, the researcher could not find previous studies on this relationship.

4.6.2 IR Knowledge and Practices of Physicians with Experience

As described previously, the experience is categorized into three groups: the first is physicians with experience of 5 years and less, whose with experience of above 5 years to 10 years is the second category, while the third one is those with experience years of more than 10 years. Experience years as dependent variable was tested with the dependant variables, knowledge and practices by using one-way analysis of variance, also the mean and the standard deviation were calculated. The following table highlights these results.

Table 4.13: IR Knowledge and Practices of Physicians with Experience

Item	Experience	No.	Mean	Std	F	Sig.
Identity of Ionizing Radiation	5Yrs and less	64	0.6	0.2	1.580	0.209
	From 6 to 10 Yrs	73	0.6	0.3		
	More than 10 Yrs	58	0.6	0.2		
	Total	**195**	**0.6**	**0.2**		
Radiation Protection	5Yrs and less	64	0.6	0.3	0.493	0.611
	From 6 to 10 Yrs	73	0.6	0.3		
	More than 10 Yrs	58	0.6	0.2		
	Total	**195**	**0.6**	**0.3**		
Exposure	5Yrs and less	64	0.4	0.2	1.044	0.354
	From 6 to 10 Yrs	73	0.5	0.2		
	More than 10 Yrs	58	0.4	0.2		
	Total	**195**	**0.4**	0.2		
Risk	5Yrs and less	64	0.6	0.1	1.142	0.321
	From 6 to 10 Yrs	73	0.6	0.2		
	More than 10 Yrs	58	0.6	0.1		
	Total	**195**	**0.6**	**0.2**		
Knowledge	5Yrs and less	64	**0.6**	0.1	0.476	0.622
	From 6 to 10 Yrs	73	**0.5**	0.1		
	More than 10 Yrs	58	**0.6**	0.1		
	Total	**195**	**0.6**	**0.1**		
Practices	5Yrs and less	64	0.6	0.2	0.131.	0.877
	From 6 to 10 Yrs	73	0.6	0.2		
	More than 10 Yrs	58	0.6	0.1		
	Total	**195**	**0.6**	**0.2**		

The table shows that there is no statistically significant difference between knowledge of participants and their experience (F= 0.476, p-value = 0.622). All knowledge items have no statistically significant differences. This indicates that years of experience do not affect the knowledge of CT dose of physicians (Lee, et al, 2004, Heyer et al, 2007). There is no statistically significant difference between practices of the participating physicians and their years of experience (F = 0.131, p-value = 0.877)

4.6.3 IR Knowledge and Practices of Physicians with Experience Status in Radiology Department

The participating physicians were divided into two classes according to their experience in the radiology department; they either have experience or not. To examine the relation between those who have an experience in the radiology department and those who do not with their knowledge and practice, t-test was used. The mean and the standard deviation were also calculated. Table 4.14 shows the results.

Table 4.14: Experience Status in Radiology Department in Relation to Physicians Knowledge and Practices

Item	Technical Experience	No.	Mean	Std	t	Sig.
Identity of Ionizing Radiation	Yes	35	0.6	0.2	0.302	0.763
	No	175	0.6	0.3		
Radiation Protection	Yes	35	0.7	0.3	1.584	0.115
	No	175	0.6	0.3		
Exposure	Yes	35	0.5	0.2	0.733	0.464
	No	175	0.4	0.2		
Risk	Yes	35	0.6	0.1	1.393	0.165
	No	175	0.6	0.2		
Knowledge	Yes	35	0.6	0.1	1.613	0.108
	No	175	0.6	0.1		
Practices	Yes	35	0.6	0.1	0.444-	0.658
	No	175	0.6	0.2		

The results in the above table shows that there are no statistically significant differences between knowledge and experience status in the radiology department (F= 1.613, p-value = 0.108). Knowledge items with experience status in radiology department do not have any statistically significant difference.

Note: Those with an experience in radiology department have got higher means of scores in radiation protection knowledge item (0.7) and exposures knowledge (0.5) than those who have no experience 0.6 for radiation protection knowledge and 0.4 for exposure knowledge item. There is no statistically significant differences between those who have experience in the radiology department and those who have not with practices of the participating physicians (T = 0.44, p-value = 0.658). According to the researcher's knowledge, there are no studies conducted on those relationships, except one study which had indicated that the field of clinical training does not affect the physicians' knowledge of CT doses (Heyer, et al, 2007). Another study by Soye, 2000 had shown that training in radiology departments affects awareness about radiation doses significantly with a p-value of less than < 0.05.

4.6.4 IR Knowledge and Practices of Physicians with Type of Department

Hospital departments are divided into four main departments; surgery, internal medicine, pediatrics, and obstetrician departments. The department type was considered as an independent variable in this study. To test the relationship of the type of the department with the knowledge and practices of physicians regarding IR and its risk, one-way analysis of variance was conducted in addition to other descriptive calculations such as mean and standard deviation. The following table shows the results of these statistics.

Table 4.15: IR Knowledge and Practices of Participating Physicians with Type of Department

Item	Department	No.	Mean	Std	F	Sig.
Identity of Ionizing Radiation	Surgery	84	0.6	0.2	0.210	0.889
	Internal Medicine	69	0.6	0.2		
	Pediatrics	31	0.6	0.3		
	Obstetrician	26	0.6	0.3		
	Total	**210**	**0.6**	**0.2**		
Radiation Protection	Surgery	84	0.6	0.3	0.189	0.904
	Internal Medicine	69	0.6	0.3		
	Pediatrics	31	0.6	0.3		
	Obstetrician	26	0.6	0.3		
	Total	**210**	**0.6**	**0.3**		
Exposure	Surgery	84	0.5	0.2	1.141	0.333
	Internal Medicine	69	0.4	0.2		
	Pediatrics	31	0.5	0.2		
	Obstetrician	26	0.4	0.2		
	Total	**210**	**0.4**	**0.2**		
Risk	Surgery	84	0.6	0.1	1.577	0.196
	Internal Medicine	69	0.6	0.2		
	Pediatrics	31	0. 6	0.1		
	Obstetrician	26	0.6	0.2		
	Total	**210**	**0.6**	**0.2**		
Knowledge	Surgery	84	0.6	0.1	0.825	0.482
	Internal Medicine	69	0.6	0.1		
	Pediatrics	31	0.5	0.1		
	Obstetrician	26	0.5	0.2		
	Total	**210**	**0.6**	**0.1**		
Practices	Surgery	84	0.6	0.2	2.269	0.082
	Internal Medicine	69	0.6	0.2		
	Pediatrics	31	0.5	0.1		
	Obstetrician	26	0.6	0.2		
	Total	**210**	**0.6**	**0.2**		

There are no statistically significant differences between total knowledge of the physicians regarding IR and its risk, and the department type (F = 0.825, p-value = 0.482). The items of knowledge also do not have any statistically significant differences with department types.

Note: The surgery and internal medicine physicians had a higher total knowledge with mean 0.6 than those of the pediatrics and obstetrics with mean of 0.5.

There are no statistically significant differences between practices of physicians regarding IR risks and department types (F = 2.269, p-value = 0.082).

Note: The pediatricians have got lower mean of scores (0.5) than those of the other departments.

4.6.5 IR Knowledge and Practices with X-Ray Using Physicians

Physicians either use x-ray in their interventional practices or not. To test if the physicians who use x-ray in their interventional have a higher knowledge and practices than those who do not use it, the t-test was conducted. Table 4.16 shows the results of t-test, means and standard deviation.

Table 4.16: IR Knowledge and Practices with Using X-Ray status

Item	Using X- Ray	No.	Mean	Std	t	Sig.
Identity of Ionizing Radiation	Yes	64	0.6	0.3	0.206	0.837
	No	146	0.6	0.2		
Radiation Protection	Yes	64	0.6	0.3	1.395	0.164
	No	146	0.6	0.3		
Exposure	Yes	64	0.5	0.2	0.962	0.337
	No	146	0.4	0.2		
Risk	Yes	64	0.6	0.1	0.285	0.776
	No	146	0.6	0.2		
Knowledge	Yes	64	0.6	0.1	0.329	0.742
	No	146	0.6	0.1		
Practices	Yes	64	0.7	0.2	4.904	0.000
	No	146	0.5	0.1		

The above table shows that there are no statistically significant differences between physicians' knowledge and using x-ray status (T = 0.329, Sign. = 0.742) and knowledge items.

Note: The participating physicians who use x-ray have got a higher mean of scores (0.5) than those who not use have got 0.4.

There is a clear difference between the mean of those who use x-ray and those who do not use regarding their practices. The difference is statistically significant by using t-test, where the T value = 4.904 and the p-value is < 0.05.

4.7 Correlation between IR Knowledge and IR Practices among Participating Physicians

The two dependent variables in this study are knowledge and practices of physicians regarding IR and its risk. To test if the dependent variables correlate with each other, Pearson's correlation coefficient was calculated as shown in table 4.17.

Table 4.17: IR Knowledge and IR practices

		Knowledge percents	Practices percents
Knowledge percents	Pearson Correlation	1	.177(*)
	Sig. (2-tailed)	.	.010
	N	210	210
Practices percents	Pearson Correlation	.177(*)	1
	Sig. (2-tailed)	.010	.
	N	210	210

* Correlation is significant at 0.05 levels.

As shown in table 5.6, Pearson's correlation coefficient results between IR knowledge and practices indicate that there is a positive correlation between IR knowledge and IR practices among the participating physicians (r = 0.177). The correlation between IR knowledge and IR practices reached a highly statistically significant level (p-value = 0.01), which means that physicians with higher knowledge are significantly more likely to have higher IR practices.

Chapter Five

Conclusion and Recommendations

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5.1 Conclusion

This study was conducted to measure the level of knowledge and practices of the physicians regarding IR risks in three governmental hospitals in Gaza Strip. About 210 of the physicians participated in this study from different departments and specialties except radiology.

The participating physicians' knowledge level was relatively low according to their response to the knowledge items, where less than 56% achieved the mean of scores and less than one sixth of them achieved a high level of knowledge. The practice of the physicians regarding IR risks is higher than their knowledge, but also is still considered as relatively low. Less than 58% of them achieved the mean of scores and about one forth of achieved a high level of practices.

The participant physicians ages were less than 35 years age group with a percent of 42%. This age group was the highest age group among them. The ages of participant physicians do not affect neither their knowledge nor their practices toward IR risks.

The participant physicians has been working in three hospitals which they are Shifa ,Nasser and EGH hospitals. The work place of physicians (hospital) does not affect neither their knowledge nor their practices toward IR risks.

Most of the participant physicians are with MBBH degree followed by Master degree. The education degree of participant physicians does not affect neither their knowledge nor their practices toward IR risks.

Most of the participant physicians are specialist physicians with a percent of 51.4 followed by general physician with 39.% and the consultant physician were about 9%. Physicians specialty does not affect neither their knowledge nor their practices statistically.

Participant physicians who work in surgery, internal medicine, pediatric and obstetrics departments do not differ neither in their knowledge nor their practices statistically.

Most of the participant physicians had an experience years between 6 to 10 years with a percent of 37.4 %. The experience years do not affect neither their knowledge nor their practices statistically from those who had not.

Participant physicians who had experience in radiology department were about 16.7 and they do not differ neither statistically in their knowledge nor their practices toward IR risks from those who had not. The participants physicians who use x-ray in their medical interventions were about 30.5%. Using x-ray by physicians does not affect their knowledge but significantly affect their practices toward IR risks, so more care and attention should be taken by those who use x-ray. In spite of these statistically significant differences 44% of the physicians who use x-ray do not follow ALARA principle or they do not know it.

5.2 Recommendations

Knowledge about IR risk is important to physicians in order to help them in making justification and to be able to communicate and to counsel the patients about it. This may decrease somewhat unnecessary examinations and encourage the physicians to be more positive in their practices toward IR examinations. According to the study findings the following recommendations are suggested.

- Increasing the knowledge of physicians about medical IR risks through the dissemination of a booklet or a fact sheet about this issue.
- Physicians who use x-ray should receive a radiation protection training in order to protect their patients and themselves.
- Educating the physician about the benefits of risk assessment of medical IR examinations through attending radiology courses.
- There is a necessity to put a clear protocol for requesting an IR imaging and this protocol should be disseminated among physicians.
- Supervision should be practiced to make to assure that physicians adhere to and comply with these protocols.
- Encourage the physicians to communicate with radiologist and to counsel their patients.
- There is a necessity to put a strategy for requesting a high dose diagnostic imaging by forming committees in the hospitals to eliminate unnecessary examinations.
- Universities should take care for IR issues and reinforce their curricula about radiology and radiation protection.

Further recommended researches:

- Studying the knowledge and practices of physicians across governmental and private hospitals on all Gaza governorates for the results to be more representative and hence can be generalized.
- Studying the attitude of physicians about IR risks.
- Similar studies should be done on the dentists.
- Qualitative researches are recommended to assess the weakness points of physicians' knowledge and practices about IR risks.

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Annexes

Annex (1)

Palestinian National Authority
Ministry Of Health
Hospitals General Administration

السلطة الوطنية الفلسطينية
وزارة الصحة
الإدارة العامة للمستشفيات

الرقم: أ . م

التاريخ: ٢٠٠٨/١٢/٢

تـعـمـيـم

الأخوة / مدراء المستشفيات المحترمون ،،،

تحية طيبة وبعد :

الموضوع/ ترشيد الطلب على فحوصات الأشعة

الترشيد يعني العقلانية في الاستخدام وليس حرمان المرضى المستفيدين من الخدمة

نظرًا للظروف الصعبة والاستثنائية التي يمر بها قطاع غزة من حصار وإغلاق للمعابر مما أدي إلى تراجع وشح في الموارد الطبية على صعيد التشغيل والصيانة فعليه نجد أنه من الجدير بالتذكير ببعض الأمور التي تصب في خانة ترشيد الطلب على موارد الوزارة بما يمكنها من الصمود أمام هذا الحصار الظالم ومن الاستمرار لتقديم الخدمات والمهام المنوطة بها للجمهور وفق شروط الجودة وحسب السياسة العامة للوزارة .

فيطيب لنا أن نحيط سيادتكم علمًا ، أن هناك تزايد ملحوظ وإفراط شديد في الطلب لفحوصات تصوير بالأشعة من قبل الأخوة الأطباء وأحيانًا بشكل غير مبرر ومبالغ فيه دون الأخذ بعين الاعتبار جودة الخدمة المقدمة والتكلفة الباهضة واستنزاف الأجهزة وتعطلها وصعوبة توفير مستلزمات الأشعة وقطع الغيار في ظل هذا الحصار الظالم ، بالإضافة إلى الأضرار الناجمة عن الفحوصات وتعرض المرضى لمخاطر الأشعة (حيث أن مرضى قطاع غزة يتعرضوا للأشعة في الأغراض الطبية بنسبة كبيرة جدًا تفوق معدل ما يتعرض له الآخرين في الدول الأخرى بأربعة أضعاف المعتاد سنويًا)
فلذلك :

١- نناشد جميع الإخوة الأطباء في المستشفيات ونؤكد بضرورة العمل على ترشيد وتقنين الطلب على فحوصات الأشعة بمراعاة ما يلي :

- طلب الأشعة للمريض بعد فحصه إكلينيكيًا وتحديد العضو المراد تصويره بدقة .
- تعبئة النموذج الخاص بفحص الأشعة ورقم الملف الطبي للمريض مع ختم الطبيب المعالج .
- يقتصر طلب الفحوصات الملونة والالتراساوند من قبل الأخصائي فقط ، واعتماد طلب فحص CT من رئيس القسم.

٢- نؤكد على الأخوة العاملين بأقسام الأشعة بضرورة الالتزام بالتعميمات السابقة بخصوص :

- عدم تصوير أي حالة إلا بعد تسجيلها رسميًا واستيفاء البيانات كاملة وقيمة المساهمة المالية وختم الطبيب المعالج .
- يقتصر التصوير في الحالات في الفترة المسائية والليلية على الحالات الطارئة والمبيت في الأقسام.
- التأكيد على عدم تواجد المتدربين وطلاب المهن الطبية الفنية في غرف التصوير لوحدهم إلا بوجود الموظف فني الأشعة وتحت إشرافه والسماح لهم بالتدريب في الفترة الصباحية وبوجود رئيس القسم فقط .

برجاء التكرم بالعلم والتنبيه على الجميع الالتزام بالتعليمات الواردة بالتعميم والأنظمة المعمول بها في وزارة الصحة

وتفضلوا بقبول فائق الاحترام ،،،،

د. محمد الكاشف
مدير عام المستشفيات

صورة للسيد/ معالي وزير الصحة
صورة للسيد/ مدير عام الرقابة الداخلية

Annex(2)

Sample Size Calculator

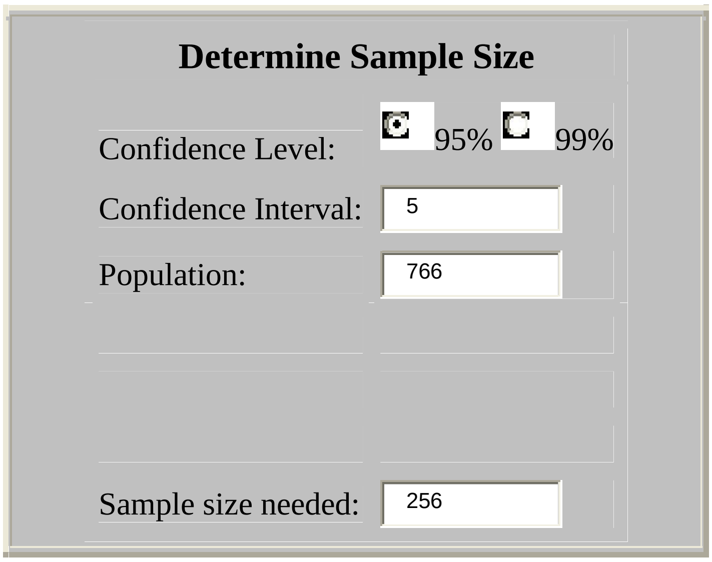
Sample Size Calculator Terms: Confidence Interval & Confidence Level

The **confidence interval** is the plus-or-minus figure usually reported in newspaper or television opinion poll results. For example, if you use a confidence interval of 4 and 47% percent of your sample picks an answer you can be "sure" that if you had asked the question of the entire relevant population between 43% (47-4) and 51% (47+4) would have picked that answer.

The **confidence level** tells you how sure you can be. It is expressed as a percentage and represents how often the true percentage of the population who would pick an answer lies within the confidence interval. The 95% confidence level means you can be 95% certain; the 99% confidence level means you can be 99% certain. Most researchers use the 95% confidence level.

When you put the confidence level and the confidence interval together, you can say that you are 95% sure that the true percentage of the population is between 43% and 51%. The wider the confidence interval you are willing to accept, the more certain you can be that the whole population answers would be within that range.

For example, if you asked a sample of 1000 people in a city which brand of cola they preferred, and 60% said Brand A, you can be very certain that between 40 and 80% of all the people in the city actually do prefer that brand, but you cannot be so sure that between 59 and 61% of the people in the city prefer the brand.



http://www.surveysystem.com/sscalc.htm

Annex (3)

Palestinian National Authority
Ministry of Health
Helsinki Committee

السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

Date: 15/8/2008

Name: Rania Al Astal

التاريخ:١٥/٨/٢٠٠٨

الاسم: رانية الأسطل

I would like to inform you that the committee has discussed your application about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

Knowledge and practices of governmental hospital physicians about health risk of ionizing radiation in Gaza Governorates.

In its meeting on August 2008
and decided the Following:-
To approve the above mention research study.

و ذلك في جلستها المنعقدة لشهر أغسطس ٢٠٠٨
و قد قررت ما يلي:-
الموافقة على البحث المذكور عاليه.

Ministry of Health Halsinki Committee

Signature
توقيع

Member	Member	Chairperson
عضو	عضو	

Conditions:-

- ❖ Valid for 2 years from the date of approval to start.
- ❖ It is necessary to notify the committee in any change in the admitted study protocol.
- ❖ The committee appreciate receiving one copy of your final research when it is completed.

Gaza Etwam – Telefax 972-7-2878166

Annex (4)

Palestinian National Authority Ministry Of Health Hospitals General Administration	السلطة الوطنية الفلسطينية وزارة الصحة الإدارة العامة للمستشفيات

الرقم: أ. د

التاريخ: ٣/٣/٢٠٠٩

الأخوة / مدراء المستشفيات المحترمين

"الشفاء- ناصر الأوروبي"

السلام عليكم ورحمة الله وبركاته ..

الموضوع/ "مشروع بحث ماجستير للطالبة رانيا الأسطل"

يرجى التكرم من سيادتكم مساعدة الطالبة رانيا الأسطل لإنجاز بحثها بعنوان :

"Knowledge of MOH physicians about risks of ionizing radiation"

وتسهيل مهمتها في جميع البيانات اللازمة من الأطباء كمتطلب للحصول على درجة الماجستير في الصحة العامة وذلك بحيث لا يتعارض مع مصلحة العمل ودون عمل تداخلات مع المرضى مع موافاتنا بصورة عن البحث وأهدافه.

وتفضلوا بقبول فائق الاحترام ،،،،

١٣/٣

د. محمد الكاشف

مدير عام المستشفيات

صورة لمدير عام تنمية القوى البشرية

صورة لمدير وحدة التخطيط والسياسات

دكتور حسين مصيطف عاشور
مدير عام مجمع الشفاء الطبي

المدير الإداري لمجمع الشفاء
رافت حمدونة

الإدارة العامة للمستشفيات – غزة الرمال- شارع عمر المختار - فندق الأمل الطابق الثاني – تليفاكس ٢٠٧٣٤...

Annex (5)

جامعة القدس

كلية الصحة العامة

حضرة الدكتور المشارك

أقوم بإجراء دراسة حول معرفة وممارسة الأطباء حول أضرار الأشعة المؤينة بالمستشفيات الحكومية ، وهذا البحث هو لإتمام متطلب للحصول على درجة الماجستير من كلية الصحة العامة من جامعة القدس – فلسطين .
والهدف من هذا البحث هو التعرف على مستوى المعرفة والممارسة لدى الأطباء .

لقد تم اختيارك كمشارك في هذه الدراسة بالطريقة العشوائية و أتطلع لمشاركتكم القيمة في إنجاح هذه الدراسة الممولة من الباحث فقط، ولن يترتب على مشاركتكم فيها أكثر من الوقت اللازم لإتمام المقابلة.

سيتم جمع البيانات من خلال استبيان وسيستغرق الوقت لذلك 20-25 دقيقة، علما بأن المعلومات التي سيتم جمعها هي لأغراض البحث العلمي فقط، وسيتم احترام سرية المعلومات.

المشاركة في هذه الدراسة اختيارية كما أنه لن يكتب اسم المشارك في هذا الاستبيان.

ملاحظة/ حصلت الباحثة على الموافقة من الجهات المعنية لإجراء الدراسة.

شكرا لحسن تعاونكم

الباحثة/ رانيه إبراهيم الأسطل

للاستفسار ******059

Annex (6)

Questionnaire form

Serial Number:

The following questions about sociodemogrphic and work related

1. Age in years ……………
2. Sex ◊ Male ◊ Female
3. Place of residency (governorate)
   a-North Gaza
   b-Gaza
   c-Midzone
   d-Khanyounis
   e-Rafah
4. Name of hospital you work in
   a) Eurapean Gaza Hospital
   b) Naser Hospital (Khanyounis)
   c) Shifa Hospital
5. Academic qualification

   a) MBBCH
   b) Postgraduate diploma
   c) Master
   d) PhD
   e) Others, specify………………………..

6. You are :

   a. Consultant
   b. Specialist
   c. General physician

7. Years of experience: …………………………………………………

8. Have you ever had any experience in the radiology department?

   ◊ Yes ◊ No

If yes, how long have you been and when?

…………………………………………….
………………………………………………….
9. Name of main department you work in

a. Surgery, specify……………
b. Internal medicine, specify……..
c. Obestrician,………
d. Pediatric, specify…………….

Others, specify………………………..

10. Have you ever received any lecture or course on ionizing radiation?

◊ Yes ◊ No

If yes, please specify according to the table below

Courses	Length	Organization	Date

- The following questions is put to realize how your knowledge about ionizing radiation and the risk of it.
- Please, answer yes/no or I don't know

	Question	Yes	No	I do not know
1	Ionization is removal of electrons from the atom			
2	X-ray is a stream of electrons with high energy			
3	Ionizing radiation sources are mainly man-made			
4	Radon gas is a natural ionizing radiation source			
5	Gamma rays and Beta particles considered as ionizing radiation			
6	Patient's physician plays a role in determining radiation dose to patients			
7	The application of the first radiation protection principle (known as Justification Principle) is the responsibility of treating physician			
8	The highest percentage contribution of radiation exposure to the population from man-made sources is from diagnostic x-ray procedure			
9	Most of plain films have lower patient doses than fluoroscopy examinations.			
10	Barium enema examinations have lower patient doses than Brain C.T.			
11	All C.T examinations have lower patient doses than diagnostic nuclear medicine investigations.			
12	Cardiovascular diseases may be induced after an exposure to high therapeutic doses of ionizing radiation			

		Yes	No	I do not know
13	Skin injuries may be induced as a result of exposure to prolonged interventional fluoroscopy examination (cardiac catheter ablation, percutaneous trans hepatic cholangiography			
14	Teratogenic effects need a certain level of ionizing radiation below which does not occur			
15	Skin injuries may be induced post exposure to C.T examination			
16	Exposure to ionizing radiation from diagnostic x-ray procedures has the probability to induce genetic effects.			
17	Fertility impairment need a certain level of ionizing radiation below which does not occur			
18	At the same age, male and female patients are at the same degree of risk when exposed to ionizing radiation			
19	Nerve cells are more radiosensitive to ionizing radiation than bone marrow			
20	Thyroid gland is more radiosensitive to radiation than the kidney			
21	The risk for radiation is the same for all ages.			
22	Exposure to radiation- such as radiotherapy- may lead to erythryma and hair loss			
23	Exposing patients to medical diagnostic imaging tests (using ionizing radiation) increases lifetime risk of cancer			
24	Exposing patients to medical diagnostic imaging tests (orbit C.T) increases the probability of inducing cataract			
25	Exposure to one medical diagnostic imaging tests has the same probability of risk as being exposed to two tests separated by some time			

26	Cataract may be induced as a result of radiotherapy exposure			
27	The risk of malformation associated with abdominal radiography(abdomen x-ray) during organogenesis stage of pregnancy is higher than natural risk of malformation			
28	MRI works by a low energy of ionizing radiation.			
29	Exposing a pregnant woman to medical diagnostic ionizing radiation increases the risk of childhood cancer to her fetus			
30	Do you know the dose in chest x-ray Equivalent of abdomen C.T.?			

The following questions about your actual practices when you request an ionizing radiation exam or when you use it.

1. Do you use x-ray in your interventional practices?

◊ Yes ◊ No

2. If yes, do you follow ALARA principle?

◊ Yes ◊ No ◊ Ido not know the principle

ALARA = As Low as Reasonable achievable

3. Do you have any protocols for requesting ionizing radiation examinations?

◊ Yes ◊ No

4. If yes, do you follow these protocols in requesting ionizing radiation examinations?

◊ Yes ◊ No

	Question	Yes mostly	Yes sometimes	No
1	Do you follow a certain criterion in requesting multiple radiological examinations? For example degradation			
2	Do you ask patients about previous exposures to ionizing radiation? (How many and when)			
3	Do you see the result of the previous radiological examinations before requesting another one?			
4	Do you record a diagnosis and patient history on the ionizing radiation requests?			
5	If you request an x-ray examination or C.T for women in reproductive age, do you ask her about pregnancy?			
6	Do you take into account a ten day role (Ten day after menstruation) when request a radiological examination?			
7	Do you make a consultation regarding the doses received by patients?			
8	Do you consult with a radiologist to know the most effective radiological procedure regarding the clinical case of your patient?			
9	Do you consult with a radiologist or a radiographer about exposure risk?			
10	Do you counsel the patients regarding the risks and benefits of ionizing radiation examination?			

11	Do you record radiological examination on patients file and the result of it?			
12	Do you request chest x-ray as routine for inpatients?			
13	Do you request x-ray examinations as patient desire for psychological purposes?			
14	If you need a biopsy procedure, do you request it under C.T.?			
15	In case of patient pregnancy, do you notify about her pregnancy on the patient request?			
16	Do you delay a radiological examination for a pregnant woman (pelvis and abdomen x-ray)?			
17	Do you request C.T. examinations just for doing something to the patients?			

Annex(7)

جامعة القدس
كلية الصحة العامة

رقم التسلسل/............

الاسئلة التالية لجمع بيانات ديموغرافية واخرى تتعلق بالعمل

1. العمر بالسنوات (..........)

2. الجنس:
   - ذكر
   - أنثى
3. مكان الإقامة:
   - شمال غزة
   - غزة
   - المعسكرات الوسطى
   - خان يونس
   - رفح
4. اسم المستشفى التي تعمل بها:
   - مجمع الشفاء الطبي
   - مجمع ناصر الطبي
   - مستشفى غزة الأوروبي
5. المؤهل العلمي:
   - بكالوريوس
   - دبلوم عام
   - ماجستير
   - دكتوراه
   - أخرى ، حدد ....
6. هل أنت طبيب:
   - استشاري
   - اختصاصي
   - عام
7. الخبرة بالسنوات: . (...........)
8. هل لديك خبرة عملية في قسم الأشعة ؟

◊ نعم ◊ لا

إذا كانت الإجابة بنعم، منذ متى وكم مدة الخبرة؟
....
....
....

. اسم القسم الذي تعمل به

- جراحة، حدد..................
- باطنة ، حدد.................
- أطفال ، حدد.....................
- جراحة اطفال
- ولادة ، حدد....................
- أخرى ، حدد.....................

10. هل تلقيت دورة حول الأشعة المؤينة ؟

◊ نعم ◊ لا

إذا كانت الإجابة بنعم أرجو التحديد حسب الجدول التالي :

اسم الدورة	المدة	الجهة المنظمة	التاريخ

- الأسئلة التالية وضعت للتعرف حول مدى معرفتكم بالأشعة المؤينة وأخطارها.
- العبارات التالية تحتمل الخطأ والصواب من فضلك أجب بنعم أو لا أو لا أعرف.

	السؤال	نعم	لا	لا اعرف
1	التأين هو نزع الكترونات من الذرة			
2	الأشعة السينية (X-ray) هي شعاع من الالكترونات ذات طاقة عالية			
3	مصادر الأشعة المؤينة بشكل أساسي هي من صنع الانسان			
4	غاز الرادون هو مصدر طبيعي للأشعة المؤينة			
5	أشعة جاما (Gamma ray) وجزيئات بيتا Beta particles تعتبران من الأشعة المؤينة			
6	دور الطبيب المعالج في الوقاية من الأشعة هو إعطاء المعلومات الطبية الكاملة عن حالة المريض			
7	تطبيق المبدأ الأول في الوقاية من الأشعة المعروف بمبدأ التبرير (Justification principle) هو مسئولية الطبيب المعالج			
8	النسبة الأعلى المساهمة في تعرض السكان للأشعة من صنع الانسان هي ناتجة عن الفحوصات التشخيصية الإشعاعية (diagnostic x-ray procedures)			

			معظم Plains films تعرض المريض لجرعة إشعاعية اقل من فحوصات fluoroscopy	9
			فحص Barium enema يعرض المريض لجرعة إشعاعية اقل من Brain C.T.	10
			كل فحوصات C.T. الأشعة المقطعية تعطي جرعة إشعاعية اقل من الجرعة المستخدمة في فحوصات الطب النووي التشخيصية	11
			Cardiovascular diseases من المحتمل ان تحدث بعد التعرض لجرعة عالية معالجة من الأشعة المؤينة	12
			إصابات الجلد من المحتمل ان تحدث بعد التعرض المطول تحت Interventional fluoroscopy (Like cardiac catheter ablation, percutaneous trans hepatic cholangiography)	13
			Teratogenic effects تحدث عند التعرض لمستوى معين من الاشعة المؤينة لاتحدث دونه	14
			الإصابات الجلدية من المحتمل ان تحدث بعد التعرض لفحص الأشعة المقطعية C.T.	15
			التعرض للأشعة المؤينة مثل الفحوصات التشخيصية بالأشعة السينية(X-ray) تعرض المريض لاحتمال حدوث تغيرات جينية	16
			العقم الناتج عن الأشعة يحتاج إلى مستوى معين من الجرعة الإشعاعية لا يحدث دون الوصول إليه	17
			الإناث والذكور في نفس العمر هم على نفس الدرجة من الخطورة الناتجة عن التعرض للأشعة المؤينة	18
			الخلايا العصبية(Nerve cells) هي أكثر حساسية للأشعة (radiosensitive) من خلايا النخاع العظمي (Bone marrow)	19
			الغدة الدرقية(Thyroid gland) هي أكثر حساسية للأشعة من الكلى	20
			خطر الأشعة هو نفسه لجميع الأعمار	21
			التعرض لجرعات إشعاعية كتلك في العلاج بالأشعة قد تؤدي إلى فقدان الشعر وحدوث احمرار بالجلد(erythryma and hair loss)	22
			تعرض المريض لفحوصات طبية إشعاعية تشخيصية يزيد من احتمال الإصابة بالسرطان	23
			تعرض المريض لفحوصات تشخيصية إشعاعية مقطعية(Orbit C.T.) يزيد من احتمال حدوث الساد Cataract	24
			تعرض المريض لصورة إشعاعية واحدة يعرضه لنفس الدرجة من الخطورة الناتجة عن تعرضه لصورتين إشعاعيتين يفصل بينهما بعض الوقت	25

			Cataract الساد قد تحدث نتيجة للعلاج بالأشعة	26
			خطر التشوه الخلقي الناتج عن صورة للبطن(abdomen x-ray) في مرحلة تخليق الأعضاء هو أعلى من الخطر الطبيعي للتشوه الخلقي	27
			MRI التصوير بالرنين المغناطيسي يعمل بأشعة مؤينة ذات طاقة قليلة	28
			تعرض المرأة الحامل للفحوصات التشخيصية الإشعاعية الطبية، يعرض جنينها لزيادة خطر الإصابة بالسرطان في مرحلة الطفولة	29
			هل تعرف جرعة الأشعة التي يتعرض لها المريض في Brain C.T. مقارنة بجرعة صورة الصدر	30

الأسئلة التالية حول ممارستك الفعلية عند طلب فحص أشعة مؤينة لمرضاك:

1. هل تستخدم الأشعة X-ray في Interventional practices؟

◊ نعم ◊ لا

2. إذا كانت الإجابة بنعم، هل تتبع مبدأ ALARA؟

◊ نعم ◊ لا ◊ لا اعرفه

ALARA = As Low as Reasonable achievable

3. هل لديكم بروتوكولات بخصوص طلب الفحص الإشعاعي؟

◊ نعم ◊ لا

4. إذا كانت الإجابة بنعم هل تتبع هذه البروتوكولات عند طلب فحص الأشعة؟

◊ نعم ◊ لا

لا	نعم أحيانا	نعم غالبا	السؤال	
			هل تتبع معيار معين عند طلب عدة فحوصات إشعاعية؟ مثلا التدرج عند طلبها	1
			هل تسأل مريضك عن الفحوصات الإشعاعية السابقة؟ متى وكم عددها	2
			هل ترى نتيجة الفحوصات الإشعاعية السابقة قبل طلب فحص جديد؟	3
			هل تقوم بتسجيل التشخيص المبدئي والتاريخ المرضي على طلب فحص الأشعة؟	4
			عند طلب فحص x-ray أو .C.T لامرأة في العمر الإنجابي هل تقوم بسؤالها عن الحمل؟	5
			هل تأخذ بعين الاعتبار قاعدة العشرة أيام الآمنة من بداية الدورة عند طلب فحص إشعاعي لامرأة في عمر الإنجاب؟	6
			هل تقوم بعمل استشارات حول الجرعة الإشعاعية التي يتلقاها المريض؟	7
			هل تقوم باستشارة طبيب الأشعة لمعرفة الفحص الإشعاعي الأمثل للحالة الإكلينيكية لمريضك؟	8
			هل تقوم باستشارة طبيب الأشعة او فني الأشعة حول أخطار التعرض للأشعة؟	9
			هل توضح لمريضك الفوائد من فحوصات الأشعة والأضرار الناتجة عن التعرض للأشعة المؤينة؟	10
			هل تقوم بتسجيل اسم الفحص الإشعاعي ونوعه ونتيجته على ملف المريض؟	11
			هل تطلب صورة الصدر chest ray كروتين لمرضاك؟	12
			تقوم بطلب فحص اشعاعي نتيجة لرغبة المريض لأسباب نفسية؟	13
			فيما لو احتجت لعمل خزعة (عينة) هل تطلبها تحت .C.T؟	14
			اذا كانت المريضة حامل ،تقوم بالتنويه لذلك على طلب فحص الاشعة ؟	15
			هل تقوم بتأجيل عمل فحص إشعاعي لامرأة حامل (()abdomen and pelvis x-ray؟	16
			هل تطلب فحص الأشعة المقطعية فقط لعمل شيء ما للمريض؟	17

Annex (8)

قائمة بأسماء السادة المحكمين لأداة قياس المعرفة والممارسة لدى الأطباء بالمستشفيات الحكومية- محافظات غزة:

1	أ. إبراهيم عباس	نائب مدير دائرة الأشعة بالإدارة العام/ فني أشعة
2	د. بسام أبو حمد	منسق عام برامج كلية الصحة العامة/ دكتوراه إدارة صحية
3	د. جمال صافي	محاضر بجامعة الأزهر/ دكتوراه علم سموم
4	د. جميل شبير	طبيب أشعة
5	أ. رامي الأغا	فني بقسم الأشعة بمستشفى ناصر / فيزيائي طبي
6	د. سامي الأغا	محاضر بجامعة الأزهر/طبيب أشعة
7	أ. علي الخطيب	محاضر بكلية المجتمع / صحة عامة
8	د. كمال جبر	مدير دائرة الأشعة بمستشفى الشفاء/ طبيب اشعة
9	د. يحيى عابد	محاضر بجامعة القدس/ دكتوراه علم أوبئة

العنوان:

معرفة وممارسات الأطباء حول أضرار الأشعة المؤينة في المستشفيات الحكومية بمحافظات غزة.

اعداد:

رانيه ابراهيم الاسطل

اشراف:

د.يوسف ابو صفية

ملخص:

ازداد استخدام الأشعة المؤينة في الطب بسرعة كبيرة وخاصة في المجالات التشخيصية. ولا يخفى على أحد الدور الهام الذي تلعبه الفحوصات الإشعاعية التشخيصية في التعرف على كثير من الأمراض و تشخيصها .ولكن الأشعة المؤينة كما هو معروف تعتبر من المواد المسرطنة الذي قد يتسبب تزايد استخدامها في انتشار حالات السرطان الناتجة عن الأشعة.

في الطب لا بد أن تكون الفائدة من مثل هذه الفحوصات أكبر من الخطر المحتمل أن ينتج عنها .ويلعب الأطباء دورا في تعريض المرضى لمثل هذه الأشعة نتيجة لطلبهم فحوصات إشعاعية لهم. لذلك جاءت هذه الدراسة لتقييم مستوى المعرفة الممارسات لدى الأطباء حول أضرار الأشعة لتحسين ممارساتهم وبالتالي تقليل الأخطار الناتجة عن تعريض المرضى للأشعة.

هذه الدراسة هي دراسة وصفية تحليلية مقطعية وبلغ عدد الأطباء المشاركين في هذه الدراسة 300 طبيبا تم اختيارهم وفق الطريقة النسبية الطبقية العشوائية في ثلاث مستشفيات حكومية بقطاع غزة وهي مستشفى الشفاء بغزة ،مستشفى ناصر بخانيونس ومستشفى غزة الأوروبي جنوبي خانيونس. وقد أخذت الاعتبارات الأخلاقية بعين الاعتبار أثناء إجراء هذه الدراسة.وجمعت البيانات من خلال استبانة ذاتية التعبئة وزعت على الأطباء المشاركين وقد استجاب 210 طبيبا للدراسة، وبذلك تكون نسبة الأطباء حوالي 70%.

وتبين من الدراسة أن مستوى معرفة الأطباء لأضرار الأشعة وفقا لإجاباتهم حول أسئلة الاستبانة ضعيف نسبيا (اقل من 56%).14%فقط من بينهم حققوا مستوى عال من المعرفة.أما ممارساتهم

للتقليل من أضرار الأشعة فكانت أعلى بقليل من مستوى معرفتهم ولكنها تعتبر أيضا ضعيفة نسبيا وفقا لإجاباتهم على أسئلة الاستبانة (حوالي 58%).وحقق من بينهم مـــا يقـــارب 24% مـــستوى ممارسة عال لتفادي أضرار الأشعة.

وقد كانت الفئة العمرية(اقل من 35 سنة) للأطباء المشاركين في هذه الدراسة بنسبة 42%. وهي النسبة الأعلى بين الفئات العمرية الأخرى.ولم يؤثر العمر على مستوى معرفة وممارسة الأطبـــاء حول أضرار الأشعة .

لم يؤثر مكان العمل (المستشفى)في الشفاء وناصر ومستشفى غزة الأوروبي على مستوى معرفـــة وممارسة الأطباء المشاركين حول أضرار الأشعة.

معظم الأطباء المشاركين كانوا من حملة بكالوريوس الطب وتبعهم حملة الماجـــستير.ولـــم يـــؤثر مستوى المعرفة والممارسة لدى الأطباء حول أضرار الأشعة.

اختلاف الاقسام التي يعمل بها الطباء المشاركون من جراحة ، باطنه، ولادة وأطفال لم يؤثر بينهم إحصائيا من حيث معرفتهم وممارستهم حول أضرار الأشعة.

كما وأن سنوات الخبرة والخبرة في أقسام الأشعة من عدمها لم تؤثر أيضا على مستوى ومعرفة وممارسات الأطباء حول أضرار الأشعة.أما الأطباء الذين يستخدمون الأشعة في تدخلاتهم الطبيـــة كانوا بنسبة حوالي 30.5%.وكانوا أكثر ممارسة إيجابية من غيرهم والفارق كان ذو دلالة إحصائية ولكن استخدامهم للأشعة لم يؤثر على مستوى المعرفة لديهم.

أوصت الباحثة بأولوية وضرورة زيادة مستوى المعرفة لدى الأطبـــاء حـــول أضـــرار الأشـــعة وضرورة إعطاء دورات تدريبية ومعرفية للوقاية من الأشعة للأطباء الذين يـــستخدمون الأشـــعة المؤينة في تدخلاتهم الطبية، وضرورة وضع بروتوكولات لتنظم ممارسات الأطبـــاء حـــول هـــذه الأضرار والتأكد من التزامهم بتلك البروتوكولات.