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Rational Use of Neurological Computerized Tomography Scan at Shifa Hospital

Abdelrazeq Beram

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Submitted By

Abdelrazeq Beram

B.Sc. in Radiology- Al-Azhar University - Palestine

Supervisor

Dr. Yousef Abu-Safieh

Associate Professor of Environmental Science

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Rational Use of Neurological Computerized Tomography Scan at Shifa Hospital

Prepared By: Abdelrazeq Beram

Registration No: 20912614

Supervisor: Dr. Yousef Abu-Safieh

Master thesis submitted and accepted: / /

The names and signatures of the examining committee members are as follows:

1- Head of Committee: Dr. Yousef Abu-Safieh	Signature……...
2- Internal examiner: Dr. Yehia Abed	Signature……...
3- External examiner: Dr. Samy Al-Agha	Signature……...

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

"وَلْيَخْشَ الَّذِينَ لَوْ تَرَكُوا مِنْ خَلْفِهِمْ ذُرِّيَّةً ضِعَافًا خَافُوا عَلَيْهِمْ فَلْيَتَّقُوا اللَّهَ وَلْيَقُولُوا قَوْلًا سَدِيدًا"

صدق الله العظيم

"النساء آية رقم ٩ "

Dedication

I dedicate this work to

my great mother, soul of my father, soul of my brother: mahmoud, soul of my great friend: Ashraf Alejla, my sisters, my brothers, my wife and my lovely kids who gave me great support and patience, help and encouragement.

Abdelrazeq Beram

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 study or any part of the same has not been submitted for a higher degree to any other university or institution.

Signed

Name: Abdelrazeq Beram

Date: / /

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Abstract

Computerized tomography (CT) scan utilization in Gaza strip has dramatically increased in recent years. This has likely reflected the improved diagnostic capability of CT scan. However, the utilization of CT is tempered by the high radiation exposure to patients as well as cost and long waiting list of patients. An increase in the number of neurological CT scan examinations has been noticed since the establishment of the CT scan department which is still form the biggest problem facing the work in the department. So the rational utilization of the CT scan is a goal of all CT scans' health providers and radiology department administrators. This study aimed to assess the rational use of neurological CT scan examination in order to decrease the medical radiation exposure for patient and the cost of financial expenditure burden on the patient and Ministry of health. A triangulated cross sectional quantitative and qualitative study was conducted in order to assess the rational use of neurological CT scan examination at Shifa hospital. The instruments used in this study were 300 self-constructed questionnaires for patients who have had CT scans examination during the period of the study; reviewing of 1780 CTs requests for availability and completeness of these requests and in-depth interview for 8 stakeholders at AL Shifa hospital. A total of 2501 neurological CTs requests has been searched to detect the 1780 requests with a detective rate of 71%.

The study findings show that multiple factors affect the decision of physicians to write a CT scan request; these are complex combination of considering patients or his family and patient-health provider relationship. Most of the physicians did not write the initial diagnosis and medical history in the CT scan requests. The study also shows that 90% of the patients didn't have the previous examination before the physician writes the CT scan request for him. The study results also reveal that there is no clear and standard request which in turn affect the writing of CTs request. The study findings indicate that 2501 neurological CT scans were performed, of them 1129 brain CT scans were reviewed and males represented 57% of the patients. Headache was noted as the main reason for referral (31%) and the urgent requests represented 55% of the brain CT scan requests. The findings were completely normal in 56% of the CTs results. Patients between the ages of 0 to 9 years were exposed to radiation at higher rate than the other age groups with 28% from brain CTs examination which represents a serious problem because the infants and young children are the most vulnerable group to radiation risk. The study results also show that 615 spine CT scans were reviewed and males represented 47% of the patients. LBP with neurological sign was noted as the main reason for referral (64%) and urgent requests represented 11% of the CT scan requests. The findings were completely normal in 25% of the CTs results. Patients between the ages 40-49 were exposed to radiation at higher rate than the other age groups with 27% from spine CTs examinations.

The researcher concluded that clear guidelines are not available and the physician has to use his best clinical judgment, taking into account multiple factors such as the patient-health providers' relationship and the patient-physician relationship. The main recommendations include: reforming the policy, establishing standard protocols in order to improve the quality of health care services, creating a standard CT scan request form, conducting a training course for the benefit versus risk of CT scan radiation dose for the health providers, conducting training course for physicians who write the request of CT scan on the proper way of completing CT scan requests, and finally, launching an awareness program to the public on the risk of medical radiation.

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List of abbreviations

ACR	American College of Radiology
ALARA	As Low As Reasonably Achievable
C.T Scan	Computerized Tomography Scan
FDA	Food and Drug Administration
GDP	Gross Domestic Product
GNP	Gross National Product
GS	Gaza Strip
ICRP	International Commission on Radiological Protection
LBP	Low Back Pain
MOF	Ministry of Financing
MOH	Ministry of Health
NGOs	Nongovernmental Organizations
PCBS	Palestinian Center Bureau of Statistics
SPSS	Statistical Package for Social Sciences
UNCTAD	United Nations Conference on Trade and Development
UNRWA	United Nation Relief and Works Agency
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
USD	United States Dollar
WHO	World Health Organization

Chapter 1: Introduction

1.1 Research background

The Computed Tomography scan (CT scan) has become an important tool for medical imaging procedure. CT scan is a medical imaging procedure that uses x-ray to show cross-sectional images of the body (FDA, 2002). In addition it is considered as a noninvasive and painless process used to produce rapid and clear two-dimensional images of organs, bones, and tissues. Neurological CT scans are used to view the brain and spine. They can detect bone and vascular irregularities, certain brain tumors and cysts, herniated discs, epileptic focus, encephalitis, spinal stenosis (narrowing of the spinal canal), a blood clot or intracranial bleeding in patients with stroke, brain damage from head injury, and other disorders. Many neurological disorders share certain characteristics and a CT scan can aid in proper diagnosis by differentiating the area of the brain affected by the disorder. Scanning usually takes about 10 minutes. (Bethesda, 2005)

The amount of radiation used in a CT scan may be dangerous, and the radiation used is considerably higher than that of conventional X-ray. For this reason, physicians don't normally request a CT scan unless it is necessary to rule out a serious illness. Physicians have also worked on reducing radiation exposure to the absolute minimum to avoid dangerous exposures (Bindman, 2009). Prof. Figueroa in the ENT Today Journal in 2007 illustrated how one typical-dose of chest X-ray provides the equivalent dose of 2.4 days of radiation from natural background sources that normally occur. For one head CT, with a typical dose of 2 mSv, the equivalent dose from natural background radiation is 243 days. There are some techniques in the medical imaging that even go beyond that. Another factor to consider in radiation dosage is the type of CT scanner used. The most common today is the axial CT scanner, which is an older, single-slice design that still provides perfectly usable images. For physicians to become judicious users of technology, Dr. Figueroa said that it is imperative to establish guidelines for appropriate and acceptable CT examinations. In addition, requests for CT scanning must be generated only by qualified medical practitioners. CT examinations should not be repeated without

substantial clinical justification. There are many tools to be used but we need to be good users of those and be able to triage patients toward the correct imaging test, and, if necessary, eliminate inappropriate CT referrals (ENT Today, 2007).

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) has the mandate to assess and report levels and effects of exposure to ionizing radiation. Its reports, constitute the findings from 1997 - 2007, show that about 3.6 billion x-ray examinations were performed each year. This figure reflects an increase of more than 40 per cent or 1.1 billion from the previous decade. Most of the population dose from the procedures occurred in countries with high levels of health care where average exposure from medical uses is now equal to about 80 per cent of that from natural sources. Computed tomography scans were the major contributor, with other contributions from diagnostic X-rays, interventional procedures, nuclear medicine and others, the report said. One of the most striking changes over the past decade or so has been the sharp increase in medical exposures owing, for example, to the rapid expansion in the use of CT scanning, the report said (UNSCEAR, 2007).

Furthermore, the use of CT has increased dramatically over the last two decades (Bindman, 2009). An estimated 72 million scans were performed in the United States in 2007 (González, 2009). In Calgary Canada 12.1% of the people admitted to the emergency department with an urgent complaint received a CT scan, most commonly either of the head or the abdomen. The percentage of those who received CT varied markedly from 1.8% to 25% depending on the emergency physician who saw them (Skelly, 2010). In the emergency department in the United States, CT or MRI imaging is done in 15% of people who were presented with emergencies as of 2007 up from 6% in 1998 (Korley, 2010).

Relying on the radiation protection principle "reduction of absorbed dose without compromising the image quality" the physicians are often required to make a decision regarding referral for CT. This decision is usually based on a mixture of factors: the medical history, the physical exam, a consultant's advice, the patient's request, doctor-patient and other medical considerations. The physician has also to consider the risks of the test in terms of exposure to radiation, the cost of the test, and the cost of incidental findings resulting at times in over-investigation which can be both

expensive and potentially harmful. Moreover, the underlying anxiety of the patient and his family has a clear influence on the physician's decision. As much as brain CT is a good diagnostic test, wide use of this test on every patient with a headache, is expensive and may lead to false positive or false negative results (Sherf, 2010).

This study has evaluated the indications and results of neurological CT scans conducted at AL-Shifa Hospital in Gaza city.

1.2 Research problem

In 1994, the first C.T scan machine has been introduced in Gaza Strip at a private center. At that time the number of examinations was about 24 examinations every 24 hours and the waiting list of patients was for about 3 days. In 2000, the first C.T Scan machine was introduced in the M.O.H at AL- Shifa Hospital. Also, at that time the number of examinations increased to more than 50 examinations every 24 hours and the waiting list of patients jumped to about 30 days.

Nowadays at the M.O.H there are five C.T Scan machines in the Gaza Strip. In addition to AL-Shifa CT scan machine there is one machine at Prince Naeif Center especially for oncology patients, one at AL-Rantisi hospital for pediatric patients and two in south Gaza strip; one at Nasser Hospital and the other at the European Gaza Hospital. These two CT machines are mainly used for the patients in south of Gaza strip. In spite of this, the number of examinations at AL-Shifa Hospital has increased to approximately 60 examinations every 24 hours and the waiting list of patients has also increased to 45 days.

Most of the CT examinations conducted at AL-Shifa hospital are for neurological cases. For example, in March 2011 the number of examinations reached 1138 examinations conducted at CT scan departments including 872 neurological CT examinations comprising about 77% of the total examinations. This increase of neurological CT scan examinations has lead to the increase of radiation exposure of the patients, especially young children, which in turn may increase the risk for malignancy. This risk of developing malignancies is the greatest in the first 10 years of life. On the other hand, the increase of neurological CT scans increases the MOH expenditure. So this current research has been implemented to determine if these examinations are justified and rationally used by those who request them or they are requested due to other avoidable factors.

1.3 Justification of the study

There are no researches about the CT scan in Gaza Strip. The health providers at AL-Shifa CT scan departments complain from the increase of neurological CT examinations and claim that this increase is due to unnecessary requests for CT examinations by the physicians and that it is not rationally used by them. They also claim that there are no clear and well understood protocols and guidelines which regulate these examinations. In addition to CT scan department staff dissatisfaction because of CT scan protocol is not appropriately implemented. All of these factors have lead to long waiting lists and shift of patients to nongovernmental centers. Even though, there are many efforts that are being done by AL Shifa hospital administration and local staff to improve CT scan utilization, but there are still many challenges for improvement and regulation of these examinations. In accordance with the global interest to decrease the exposure to radiation from medical sources and instruments "the medical radiation", this research investigated the rational use of neurological CT scan examinations, and tried to establish applicable approaches to limit the growth in neurological CT scan utilization. The results of this study will be disseminated to the decision makers and related health providers in order to improve the quality of care and outcomes.

1.4 Aim of the study

The aim of this study is developing applicable approaches to limit the growth in neurological CT scan utilization, decrease the radiation exposure for patient and to decrease the financial expenditure burden on the patient and the MOH or even to reduce neurological CT uses in the future.

1.5 Objectives

1.5.1 General objective:

To assess the current utilization of CT scan and the rational use of neurological CT scan conducted at AL-Shifa Hospital.

1.5.2 Specific objectives:

- To identify the main factors affecting the increase in number of neurological C.T scan requests.
- To evaluate the indication and results of referral for neurological CT scan.
- To explore the key factors undermining physicians' requests for CT scan.
- To demonstrate the status of the validity of CT request for accuracy of the information.
- To develop recommendations and suggestions to rationalize the number of neurological CT scan requests.

1.5.3 Research questions

- Are there protocols for writing CT scan request?
- What are the factors affecting the implementation of the protocols?
- Do the relationships between the physician who writes the request and the other health providers affect writing CT scan examinations?
- Do the relationships between the physicians and the health providers with patients affect writing CT scan examinations?
- Do the anxiety of patient and his family have an effect on writing CT scan examinations?
- Does the physician alert the patient of the potential risks of radiation?
- Are there flyers to inform the patient about the radiation risks?
- Are all the C.T requests fully documented?
- Are the patients satisfied with the CT scan service?
- Is the long waiting list suitable for the burden of patients?

1.6 Context of the study

1.6.1 Demographic context

The entire area of historical Palestine is about 27,000 square km stretching from Ras Alnakura in the north to Rafah in the south. Palestine is bordered by Lebanon in the north, the Gulf of Aqaba in the south, Syria and Jordan in the east and by Egypt and Mediterranean sea in the west (Annex 1). The importance of the strategic setting of Palestine is that it is at the crossroad of three continents, Asia, Africa and Europe,

which makes it a coveted place to many of the rapists over the centuries. Palestine was placed under British mandate which had ended by "Israel" establishment in 1948, as a fulfillment of the Balfour promise in 1917 to create a homeland for Jews. As a result of that promise, many of the Palestinians became refugees in West bank (WB), Gaza strip (GS), Jordan, Lebanon, Syria, and other countries (Abu-Lughod, 1971). Currently Palestinians are living in Gaza Strip and West Bank in a total area of 6,257 km^2 which represents about 22% of historical Palestine area.

Gaza strip is a narrow piece of land located in the south of Palestine on the coast of the Mediterranean Sea (Annex 2). It has a 51km border with the 1948 occupied Palestine and an 11km border with Egypt. Gaza strip is a heavily crowded area, where approximately 1,6 million live in an area of 378 sq.km; two thirds of them are registered as refugees, estimated density is 4,750 people per sq.km. Furthermore the population is concentrated in 7 towns, 10 villages and 8 refugee camps (PCBS, 2007). The population density increases in the refugee camps, for example over 80.000 refugees live in beach camp where the area is less than one sq. km (UNRWA, 2005). Gaza Strip is divided into five governorates: North of Gaza, Gaza, Mid-Zone, Khanyounis and Rafah.

The population under 15 years old in Gaza Strip represents about 49% and 2,5% of age above 65 years (MOH, 2006). The estimated number of death per year is 5000 deaths, and the crude death rate (CDR) is 3.33 per one thousand.

1.6.2 Socio-economic situation

"Israeli" closure policies against Gaza Strip people among different times have had serious negative effects on Palestinian economic situation. After Al-Aqsa Intifada in 2000, many of Palestinian workers have lost their work in "Israel" and sharp down turn in wage income from "Israel" (World Bank, 2003).

After Palestinian legislative elections in 2006, all funds to the Palestinian government from Israel, the United States, Canada, and the European Union have been frozen. The severity of closure increased after the political unrest in June, 2007 resulting in the closure of most factories due to the lack of raw materials, loss of farmers to their revenues by preventing the export of their crops. The deteriorating economic situation in the Gaza Strip has led to the rise in unemployment rate to 65%, and 85% of households are living under the poverty line (UNCTAD, 2007).

According to Palestinian Ministry of Finance (MOF), the gross national product (GNP) in Palestine was 5.454 million US$ in 1999 and decreased to 3.720 million US$ in 2004. However, the gross domestic product (GDP) was 4.517 million US$ in 1999 and decreased to 3.286 million US$ in 2004 (World Bank, 2003). The Palestinian central bureau of statistics (PCBS) preliminary estimates for the GDP per capita for the Palestinian territory during the fourth quarter of 2009 was 354.6 US$ with an increase by 0.8% compared to the third quarter of the same year, while it showed an increase by 7.1% compared with the same quarter of 2008 (PCBS, 2010).

1.6.3 Health care system

The Palestinian's overall health is relatively good compared with neighboring countries; major outbreaks of diseases are prevented and health indicators also improved by effective health services (WHO, 2006). Life expectancy in 2005 was 72 years for males and 73 years for females and infant mortality rates were 20 per 1000 live births (MOH, 2006). The main cause of death among adults is noncommunicable diseases, in particular cardiovascular diseases. A study carried out by Johns Hopkins University (USA) and Al- Quds University (in Jerusalem) for CARE International in late 2002 revealed a bad nutritional situation among the Palestinian population. The study found that 17.5% of children aged 6–59 months suffered from chronic malnutrition. About 53% of women of reproductive age and 44% of children were found to be anemic (Al Quds University and John Hopkins University, 2002). Iron deficiency anemia represents the major nutritional problem followed by subclinical vitamin A deficiency, rickets and iodine deficiency. Furthermore, the level of chronic malnutrition among children under five years appears to be slowly increasing (WHO, 2006). The stressful life condition and "Israel" violence against Palestinians, lead to prevalence of common mental disorders, in 2003 it was reported that 40.3% among the 59% of the population were exposed directly to violence, compared with 12.6% among the 41% of the population were not exposed are suffering from mental disorders (WHO, 2006).

The health care system in Palestine is complex. There are four major health providers: MOH, United Nation Relief and Works Agency (UNRWA), nongovernmental organizations (NGOs) and private sector (Abed, 2007).

The MOH is the main health care provider in Palestine, which provides primary, secondary and tertiary services. The UNRWA provides mainly primary health care

services to the refugee population. The NGOs and private for profit sector also provide the three levels of care through a wide range of practices (WHO, 2005).

1.6.4 Computerized Tomography scan (CTs) in Gaza Governorates

There are five C.T Scan machines in the MOH. In addition to AL-Shifa CT scan machine there is one machine at Prince Naeif Center especially for oncology patients, one at AL-Rantisi hospital specialist for pediatric patients and two in south Gaza strip; one at Nasser Hospital and the other at the European Gaza Hospital. These two CT machines are mainly used for the patients in south of Gaza strip.

1.6.5 Computerized Tomography Scan Department at AL-Shifa Hospital

Al-Shifa, which means "healing" in Arabic, was originally a British Army barracks, but was transformed into a center to provide treatment for quarantine and febrile diseases by the government of the British Mandate of Palestine. Prior to the 1948 Arab-Israeli War, al-Shifa was the only hospital in Gaza. When the Egyptians administered the Gaza Strip after the war, the quarantine and febrile diseases department was relocated to another area in the city and al-Shifa developed into the central hospital of Gaza. Initially, a department for internal medicine was established, followed by a new wing for surgery, and subsequently new buildings for pediatrics and ophthalmology were added to the hospital (Husseini and Barnea, 2002).

Shifa hospital was established in 1948 on an area of over 45,000 m^2. It is located in the west part of Gaza city, and it developed over years until recently where it became Shifa medical compound. It is considered as the largest and main referral health institution in Gaza that provides secondary and tertiary health care services for more than 500,000 inhabitants (Shifa Hospital records, 2008).

The CT scan department at AL-Shifa hospital serves the patients from three governorates in Gaza Strip: North Gaza, Gaza city and Mid-zone. The population of these governorates is approximately 1,073,000 excluding the infant patients who are approximately 400,000 (PCBS, 2010). The department serves about 673,000 inhabitants, and serves all hospitals in these governorates including AL-Shifa hospital, AL-Aqsa hospital, Kamal Odwan hospital and Biet Hanoun Hospital, but not AL-Rantisi hospital which serves pediatric cases (less than 12 years old).

1.7 Operational definition

Computed tomography scan (CT scan)

It is a medical imaging method employing tomography created by computer processing. Digital geometry processing is used to generate a three-dimensional image of the inside of an object from a large series of two-dimensional X-ray images taken around a single axis of rotation. (Herman, 2009)

Radiation Dose:

When radiation interacts with body tissues and organs, the radiation dose received is a function of factors such as the type of radiation, the part of the body affected, the exposure pathway, etc. (Nickoloff, 2001)

Medical exposure

Exposure incurred by patients as part of their own medical diagnosis or treatment. (Mettler, 2000)

Radiation risk assessment

For the population ,the ICRP proposes the following so called lifetime risk coefficients for cancer mortality: 5% per Sv for low doses and 10% per Sv for high doses. A risk coefficient of 10% per Sv means that a radiation exposure of 10 mSv for 10 000 persons leads to 10 additional deaths from cancer or leukemia. (ICRP, 1991) (Shannoun, 2008).

Initial diagnosis

Initial diagnosis is defined as a narrative or record of past events and circumstances that are or may be relevant to a patient's current state of health. More formally, a comprehensive statement of facts pertaining to past and present health gathered, ideally from the patient, by directed questioning and organized under the following heads. (Fritscher, 2009)

Complain

Complain of the patient is defined as brief statement of the complaint or incident that prompted medical consultation. (Dugdale, 2001)

Medical history

Medical history of the patient is defined as the development of the current health problem from its onset to the present, prior illnesses, their treatments and sequels. (Dugdale, 2001)

Previous examination

The previous Examinations are the most important diagnostic tools of radiologist to obtain information to make an accurate diagnosis. (Dugdale, 2001)

Physical examination

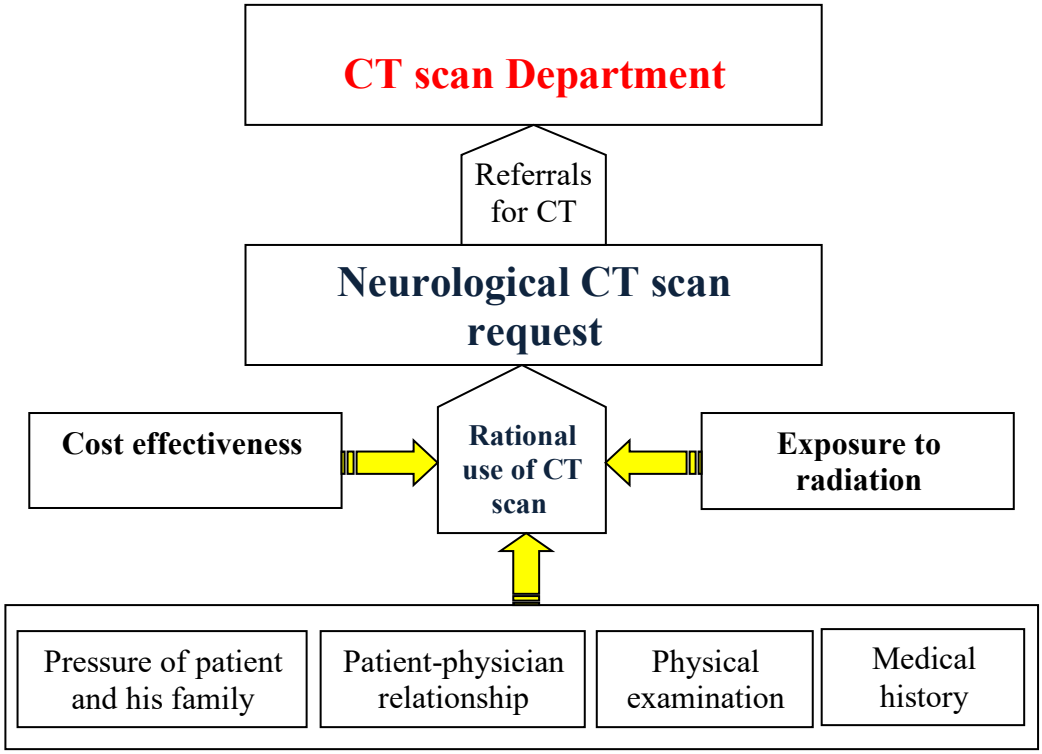
Physical examination is used to determine the condition of a person's health or physical fitness, especially for a specified activity or service and to determine the presence or absence of physical sign, including inspection, palpation, auscultation and percussion. (Dugdale, 2001)

Chapter 2: Literature review

2.1 Conceptual Framework

The conceptual framework guiding the study is shown in figure (2.1). The framework consists from two components; first: the factors that affect the writing of neurological CT scan request including the pressure of patient and his family, patient-physician relationship, patient medical history, and physical examination; Second: the disadvantage of CT scan including the risk of exposure to high radiation, and the cost effectiveness.

Figure (2.1) Neurological CT scan Utilization Framework



2.2 Literature review introduction

CT scans are considered as a very important tool for diagnosis and assessment of response to treatment in the practice of medicine, it has become most popular because it offers a quick, relatively cheap and painless method of diagnosis. But most of

previous studies confirm that the CT radiation gives high exposure for patients and may cause cancer. The advent of computed tomography (CT) has revolutionized the diagnostic radiology. Since the inception of CT in the 1970s, its use has increased rapidly. It is estimated that more than 62 million CT scans per year are currently obtained in the United States, including at least 4 million for children (Brenner and Hall, 2007).

2.3 Increased utilization of CT scan globally

Brenner and Hall said in their study that the use of CT has increased rapidly in the United States and elsewhere, notably in Japan according to a survey conducted in 1996 (UNSCEAR, 2000). The number of CT scanners per 1 million of the population was twenty six in the United States and sixty four in Japan. It is estimated that more than 62 million CT scans are currently obtained each year in the United States, as compared with about 3 million in 1980 (IMV, 2006). This sharp increase has been driven largely by advances in CT technology that make it extremely user-friendly, for both the patient and the physician (Brenner and Hall, 2007).

Prokop found that the exponentially growing performance of newer scanner generations has increased diagnostic opportunities and utilization of computed tomography. The excellent clinical results with CT, however, have to be weighed against a high radiation exposure. While radiation exposure with modern scanners is well below the diagnostic reference values of the EU for most organ systems pointed the radiation dose for retrospectively gated cardiac examinations can be substantially of higher dose for which cancer induction been proven. For children, the situation may also be critical if scanning parameters are not adapted to their smaller size and increased radiation risk: the risk-benefit ratio may then no longer favor CT. The application of CT for young patients, patients with favorable prognosis and for frequent follow-up examinations will increase the radiation risk to the individual and the population. Prokop said that the growth rates for CT utilization in Germany are well below those in the United States but the increasing number of exams will lead to a substantial increase in population dose even if the dose per individual exam can be reduced. The combination of optimum scanning parameters, automated dose modulation and dose adaptation to the individual patient will help contain radiation dose. Further reduction is possible by reducing the number of scan phases, limiting

the scan length and choosing a lower tube voltage. He confirmed that most important is the close collaboration with referring physicians. Scanning technique and choice of imaging modality can only be adapted if the clinical question is clearly defined (Prokop, 2008).

A study by Border (2008) found that the CT scan utilization in the pediatric department has highly increased recently. The author recommended that alternative imaging modalities such as ultrasound (US) and magnetic resonance images (MRI) which do not expose patients to ionizing radiation be used, and protocols must be designed to maximize patient's safety by limiting radiation exposures while preserving rapid and accurate diagnosis of time-sensitive conditions (Broder, 2008).

2.4 CT scan radiation

CT examinations expose patients to doses of radiation larger than any other diagnostic radiology examination (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).

A CT for abdomen gives a high exposure to patients, where the effective dose of abdomen CT is about 10 mSv that is equivalent to 500 chest X-rays and 3.3 years of exposure to natural ionizing radiation in the U S. While a CT for head gives an effective dose of about 2mSv which is equal to 100 chest X rays (Radiology info 2007).

2.5 Cancer Risks from CT in the United States

Two new studies published in December 2009 of the Archives of Internal Medicine demonstrated that CT scans are widely used and are an invaluable tool for medical imaging. However, the possible overuse of CT scans and the variability in radiation doses might subsequently lead to thousands of cases of cancer (Nelson R. 2009).

In the first study, the researcher found that radiation doses from common CT procedures are higher and more variable than what is typically cited. For example, the authors note that the median effective dose of an abdomen and pelvis CT scan is often cited as 8 to 10 mSv, but they found that the median dose of this type of scan was actually 66% higher, and the median dose of a multiphase CT scan of the abdomen

and pelvis was nearly 4 times higher. The authors also found a considerable range in doses within and across the institutions included in their study, with a mean 13-fold variation between the highest and lowest dose for each CT type studied.

In the second study, researchers estimated future cancer risks from current CT scan use in the United States, and projected that 29,000 future cancers will be directly attributable to CT scans that were performed in 2007. It is expected that the majority of these projected cancers will be caused by scans of the abdomen and pelvis (n = 14,000), chest (n = 4100), and head (n = 4000), and by CT coronary angiography (n = 2700). Furthermore, the study found that more than 19,500 CT scans are performed every day in the United States; these expose each patient to the equivalent of 30 to 442 chest radiographs per scan.

In response to this news about the cancer risk from CT scans, which has been widely reported in the lay media, the American College of Radiology (ACR) has questioned the methodology used in the 2 studies. In a statement, the ACR acknowledges that the widespread use of imaging exams has resulted in increased radiation exposure, and advises that no imaging exam be performed unless there is a clear medical benefit that outweighs any associated risk. They support the concept of "as low as reasonably achievable," (ALARA) which urges providers to use the minimum level of radiation needed in imaging exams to achieve the necessary results.

However, in their statement, the ACR notes that "no published studies show that radiation from imaging exams causes cancer." They also question how the risk was measured, pointing out that the conclusions of the researchers of the studies rely largely on data that equate radiation exposure and effects experienced by atomic-bomb survivors in Japan to present-day patients who receive CT scans. Most CT scans are conducted in controlled settings, which results in limited radiation exposure to a small portion of the body, whereas atomic-bomb survivors experienced instantaneous exposure to their entire body. CT exams also only expose patients to x-rays, whereas survivors of the atomic bomb were exposed not only to x-rays, but also to particulate radiations, neutrons, and other radioactive materials.

Thus, the known biologic effects are very different for these two scenarios, and "cancer assumptions based on this paradigm should be considered, but not accepted as medical fact."The ACR also noted that, after excluding patients with cancer or within 5 years of the end of life, the studies assume that the patients undergoing CT scanning have the same life expectancy as the general population.

In the first of the two studies, Smith Bindman, MD, a professor in radiology, University of California, San Francisco, and colleagues conducted a retrospective cross-sectional study with the goal of estimating future cancer risks from current CT scan use. They assessed the radiation dose associated with the 11 most common types of diagnostic CT studies that were conducted on 1119 consecutive adult patients at 4 facilities in California between January 1 and May 30, 2008. The 11 types of CT scans evaluated in the study comprised approximately 80% of all CT scans performed. The mean patient age was 59 years, and nearly half (48%) were female.

They found that the doses of radiation varied significantly among the different types of CT scans, with the overall median effective doses ranging from 2 mSv for a routine brain CT scan to 31 mSv for a multiphase abdomen and pelvis CT scan. The comparison of organ-specific doses showed that CT coronary angiogram delivers a dose to the breast that is equivalent to approximately 15 mammography screenings. It also delivers a radiation dose to the lung that is equivalent to 711 chest x-rays. Furthermore, study estimated lifetime attributable risks for cancer by scan type from these measured doses and, as they expected, the number of CT scans that would result in a cancer varied considerably by sex, age, and type. It would take far fewer CT scans to result in a cancer in women than in men, for example, reflecting a higher cancer risk from radiation.

They estimated that one in 270 women who underwent a CT coronary angiogram at the age of 40 years will eventually develop cancer, compared with one in 600 men. For a routine head CT, the estimated risk was one in 8100 for a 40-year-old woman and one in 11,080 for a man of the same age. For 20-year-old patients, these risks were approximately double; for 60-year-old patients, they were approximately 50% lower. (Bindman S. and et al, 2009)

In the second study, Barrington de González and colleagues from the National Cancer Institute, and colleagues conducted a study to determine the estimated risk for future cancer from current CT scan use in the United States according to age, sex, and scan type. They used risk models based on the National Research Council's "Biological Effects of Ionizing Radiation" report, and organ-specific radiation doses derived from a national survey. An estimated 72 million CT scans were performed in the United States in 2007. For their calculations, the researchers excluded scans obtained in the last 5 years of life and those with a diagnostic code related to cancer, lowering the number to 57 million. The number of CT scans performed increased with

age at exposure until the age of 45 years, the study note; it is estimated that 30% of scans are performed in adults 35 to 54 years. In addition, it is estimated that about 60% of the scans were performed in women.

The projected number of incident cancers per 10,000 scans generally decreased with increasing age at exposure, and although the risk varied according to the type of scan, there were consistently high risks for chest or abdomen CT angiography and whole-body CT. When age- and sex-specific annual frequencies were combined with the estimated risk per 10,000 scans, the researchers estimated that approximately 29,000 (95% uncertainty limits [UL], 15,000 - 45,000) future cancers could be related to the number of CT scans performed in 2007. When broken down by cancer site, lung cancer was estimated to be the most common projected radiation-related cancer (n = 6200; 95% UL, 2300 -13,000). This was followed by colon cancer (n = 3500; 95% UL, 1000 - 6800) and leukemia (n = 2800; 95% UL, 800 - 4800). (González A. and et al, 2007)

2.6 Radiation Overdoses Point up Dangers of CT Scans

In 2009, two cases under scrutiny in California were published in The New York times; one involving a large well known Los Angeles hospital and the other involved a tiny hospital in the northern part of the state, underscore the risks that powerful CT scans pose when used incorrectly. Cedars-Sinai Medical Center in Los Angeles disclosed that it had mistakenly administered up to eight times the normal radiation dose to 206 possible stroke victims over an 18-month period during a procedure intended to get clearer images of the brain. The other case at Mad River Community Hospital in Arcata, involving a 2 ½-year-old boy complaining of neck pain after falling off his bed has led to the revocation of an X-ray technician's state license for subjecting the child to more than an hour of CT scans. The procedure normally takes two or three minutes.

The hospital's radiology manager at the time, Bruce Fleck, called the overdose a "rogue act of insanity." Robert Schlag, chief of the state's division of Food, Drug and Radiation Safety, said it was "one of the more egregious extreme cases that I have ever seen." The Arcata case is considered particularly disturbing because children are more vulnerable to the long-term effects of radiation, including cancer, For reasons not yet fully understood, the X-ray technologist, Raven Knickerbocker, activated the

CT scan151 times on the same area, state investigators concluded. A normal test involves some 25 images, Mr. Schlag said. The test was terminated only after the victim's father, who had been holding his son still, began to worry that it was taking too long (Bogdanich, 2009).

2.7 The European guidelines on quality criteria for CT

In 1989 the National Radiological Protection Board showed that despite comprising only 2% of all examinations, CT contributed around 20% of the collective dose to the population from diagnostic imaging (Shrimpton, 1991). Subsequent analyses for the United Kingdom (UK) suggest that this may have risen to 40% (Shrimpton, 1998). Patient doses from CT are among the highest in diagnostic radiology; an abdominal examination in an adult with an effective dose of 10 mSv has been estimated to increase the lifetime risk of fatal cancer by 1 in 2000 (NRPB, 1992).

The quality criteria concept has been developed by the European Commission (EC) as an effective method for optimization in medical imaging. The definition of quality criteria for CT was carried out by a multinational group composed of radiologists and physicists. Prescribing quality criteria is necessarily more complex in CT than in conventional radiography in view of the specific requirements of multiple applications. The Working Party therefore concentrated on common applications of CT and the resulting guidelines cover six major areas of use (Jessen, 2000). For each of these areas, recommendations are made on preparatory steps before investigation, on the criteria for acceptable images and for good imaging practice, and on clinical conditions that impact on good imaging performance. Integral to the Working Party's approach was the concept of reference dose levels. These are relatively easy to define in conventional radiography but less readily provided in CT owing to the complexity of dosimetry and the variability of examinations (Nagel, 2000). Initial values of The Computed Tomography Dose Index (CTDI) have been suggested for some common examinations on adult (European Commission, 2000) and pediatric patients (Shrimpton, 2000)

In view of the magnitude of its task, one of the tasks completed by the group is a pilot study regarding application of the criteria, covering five types of examination over four countries (Jurik, 2000). This study was instrumental in providing reference doses

to complement those available from previous contention that diagnostic criteria could be used to optimize CT scan to achieve dose reduction. The Working Party is currently planning a European field survey focusing on evaluating examination protocols and assessing patient dose, with a further survey intended to target image quality and dose in a selected patient group. It is intended that this work, together with that of other centers, should provide a scientific foundation for effective examination guidance in the future, particularly in relation to reference dose levels and image quality.

For the present it behoves all involved in CT scan to observe the following:

There must be clear justification for CT scan this means active consideration of whether the examination is required, whether it could be replaced by ultrasound or MRI and, if accepted, whether it conforms to current clinical guidelines. A single spiral exposure or sequence of serial scans should be used where this alone will satisfy clinical need. Additional scans with contrast enhancement should only be used when there is clear clinical evidence to support their application. (Golding 2002).

2.8 Previous relevant studies

A study was carried out in two imaging institutes serving the Southern District of Israel, between January and June 1994 in order to evaluate all referral requests and results of brain CTs ordered by primary care physicians for ambulatory patients. The study results found that more than 3,230 CT scans were performed, of them 1,238 (38.3%) were brain CT scans. Of these, male represented 40% (493), female 57% (711), and in 3% (34) the gender was not mentioned. The initiator of the referral was the primary care physician in 38% of the cases, a consultant in 57% and unknown in 5% of the tests. The overall annual referral rate was calculated to be 7.29 per 1000 population. In general, the referral rate for brain CT increases with age to peak at the oldest age group of over 80 with the exception of the 60 to 69 age group where a drop in the referral rate is noticed. The referral rate of the patients over the age of 80 years was 33.86, which is 3 to 4 times the rate in the previous age groups (20-79).

Moreover the study results denote the indications leading to the referrals. Headache without neurological findings was noted as the main reason in 468 (38%) of the patients, dizziness in 217 (18%) patients, and trauma in 107 (9%) patients. The

majority of the physicians did not indicate any suspected diagnosis (760 patients, 61%). Nevertheless, in 196 patients (16%), the postulated diagnosis was tumor.

Furthermore the study also demonstrated that the majority of the patients the CTs were completely normal (815 patients, 65.8%). In 39 patients (3.2%) a brain tumor was observed, and in 19 patients (1.5%) a cyst was found. Other findings included atrophy (100) 8%; brain stroke, CVA (60) 5%, and sinusitis in (104) 8% of the patients. Women were diagnosed with brain tumor at a significantly higher rate than men ($p<0.05$) though for other diagnoses the rates were similar. Age was also found to be a significant factor. In most cases the age group of 20-49 year old, were diagnosed with an adverse outcome at a higher rate than the other age groups ($p<0.00001$). A presumed diagnosis was not indicated in about two thirds of the brain CTs. In only 8 patients who were suspected to have a tumor the diagnosis was confirmed. In 13 (34.2%) of the patients with a headache with no neurological findings a tumor was found, sinusitis in 28 (28.9%) patients, and a CVA in 7 (17.5%) patients (Sherf, 2010).

Finally the use of CT scan as a screening technique provides an additional dimension to the controversy. The literature discloses conflicting views with respect to radiation exposure from computed tomography. Whereas all the literature explains that the examinations of CT have increased in most of the hospitals in the world, all of them recommend the reduction of CT examinations and development of strategies to limit the growth of CT utilization.

Chapter 3: Methodology

3.1 Study design

The design of this study is a descriptive analytical cross-sectional with quantitative and qualitative design, focuses on the rational use of neurological C.T scan at Shifa Hospital. This design is selected because the cross-sectional study design assesses the dependent variables and independent variables at the same time, and it is simple and short. Also it is an analytical in as much as it can compare between groups (Yale University, School of Medicine, 2007).

3.2 Period of study

The study started immediately after having the University and Helsinki committee approval in March 2011 then the approval from the general director of Human Resources and Development in MOH taken in June 2011. Data collection for a self-constructed interview questionnaire, neurological CT scan requests and interviews took three months. After that, data entry, data cleaning, data analysis, and data interpretation were conducted in one and a half months. Final research report was written in October-November 2011.

3.3 Study setting

The study was carried out in CT scan department at AL-Shifa Hospital, and included all neurological CT requests and patients who have had CT scan examinations at the time of the data collection.

3.4 Study population

The study population consisted of three components. The first one was the neurological CT requests performed at CT department at AL-Shifa hospital from 1/6/2011 until 31/8/2011. The second was the patients from three governorates in Gaza strip: North Gaza, Gaza city, Mid-zone, and included over 800 neurological patients per month conducted at the CT scan department at Al-Shifa hospital. The third component was key informants at AL-Shifa hospital and included the director

generals of both radiology and surgery departments, two from radiology department, two from neurosurgery department, and two from neurology department.

3.5 Sampling process

All referral requests and results of neurological CTs ordered by physicians from 1/6/2011 until 31/8/2011 were 2501 neurological CT requests, and 300 referral patients selected by using random sampling in order to increase the representativeness and decrease the bias.

3.6 Selection criteria

3.6.1 Inclusion criteria

All requests and results of neurological CTs in CT scan department at AL-Shifa hospital and 300 patients who have neurological CT scans were included in this study.

3.6.2 Exclusion criteria

The non neurological CT scan requests, results and patients conducted at AL-Shifa Hospital and all other CT scan departments in Gaza Strip.

3.7 Study instrument

In this research a triangulated approach was used: the first was a self-constructed interview questionnaire for the patients who have had CT scan examinations which include for the availability and completeness of CT scan request related to patient's socio demographic information, clinical data, knowledge of radiation risk**,** factors that affect the writing of CT scan request, the cause of CT scan examination and the satisfaction with the services within the CT scan department. (Annex 5), the second instrument was a checklist for standard CT scan request, in order to review the availability and completeness of CT scan request related to patient's demographic information, clinical data, medical data, name of hospital, department name, signature of physician and result of the examination, a checklist form has been approved after a meeting with the director of radiology department at AL-Shifa hospital, radiologist and technicians who have an experience of more than ten years in the department of radiology (Annex 6), and the third instrument was In-depth interview with the key people at AL-Shifa hospital. The themes of key informant interview used to assess the

completeness and accuracy of personal, demographic, clinical and medical data, the results CT scan examinations, the pressure based on the physician to write CT scan request and the barriers that impede the implementation of the CT scan protocols. The interviews conducted at AL-Shifa hospital with each key informant for about half an hour (Annex7).

3.8 Validity of the research

3.8.1 Face and content validity

The study instrument was constructed after reviewing the literature related to the study, then sent with the objectives of the study to 10 experts working in the same field in order to evaluate and gets their feedback. According to their suggestions and advice, the researcher added, modified, excluded and changed some questions to be more suitable for achieving the objectives of the study.

3.9 Data management and statistical analysis

The data collected at AL-Shifa hospital CT scan department and data entry was done through the following steps: First, the data entry was done after over viewing of the questionnaires and the records review checklist; second, designing a data entry model using the computer Software Statistical Package for social sciences (SPSS) version 13; third, the coded variables entered into the computer by the researcher; fourth, data cleaning is done through checking out a number of the questionnaires and through exploring descriptive statistics frequencies for all variables; and finally all suspected or missed values were checked by revising the available questionnaire. For key informative interview, data managed by formulation of sufficient questions related to specific concerns of the study, preparing an interview guide, and the interviews conducted at AL-Shifa hospital with each key informant for about half an hour. Then interview data analyzed throw interview summary sheet, a systemic writing of data, organizing of data thematically. Then thematic presentation of qualitative results presented with the quantitative results.

3.10 Pilot Study

A pilot study for the questionnaire was conducted with 10 participants at CT scan department at AL-Shifa hospital before data collection. It provides a trial run for the questionnaire which involves testing the wordings of the questions, identifying ambiguous questions, testing the techniques used to collect data, and measuring the effectiveness of standard invitation to respondents.

3.11 Ethical and administrative considerations

The researcher was keenly committed to all ethical considerations required to conduct a research. First, ethical approvals to carry out the study were obtained from both the school of public health, Al-Quds University and Helsinki Committee (Annex 3). Second, an approval letter was sent to the director general of Human Resources Development in the MOH to arrange a meeting with the director general of AL-Shifa hospital (Annex 4). Confidentially of all data collected was completely ensured. Name were checked for completeness and not used for further procedures.

3.12 Detective and response rate

The numbers of neurological CT scan requests were found to be 1780 out of 2,501, so the detection rate was 71%. While the number of interviewed key informants was eight with 100% response rate and the number of questionnaires were 300 with 100% response rate.

3.13 Limitation of the study

- The most important limitation of the present study was the breakdown of CT scan machine.
- Unconscious patient who cannot answer the questionnaire.
- Recurrent electricity cut-offs.
- Limited time available to conduct the study.

Chapter 4: Result and discussion

In this chapter the researcher attempts to illustrate the main findings of the study using descriptive and inferential analyses. The descriptive statistics used to present the socio demographic characteristics and variations among participants and presented by tables, graphs and figures. In addition, the availability and completion of requests are analyzed. And finally presents the findings of the in depth interview.

4.1 Results of the questionnaire

4.1.1 Socio-demographic characteristics of the questionnaire participants

Table 4.1: Socio-Demographic Characteristic of the Questionnaire Participants

S n.	Item	N	%
1.	**Age in Years**		
	0-19 years	٣٨	١٢,٧
	20-39 years	١٣٦	٤٥,٣
	40-59 years	٩٨	٣٢,٧
	More than 60 years	٢٨	٩,٣
	Total	٣٠٠	١٠٠,٠
	(Mean : 36.7, Median: 36, Std. Deviation: 15.1)		
2.	**Gender**		
	Male	١٦٥	٥٥
	Female	135	٤٥
	Total	٣٠٠	١٠٠,٠
3.	**Address**		
	North	٦٦	٢٢
	Gaza	١٧٥	٥٨.3
	Mid Zone	51	17
	South	8	2.6
	Total	٣٠٠	١٠٠,٠
4.	**Level of Education**		
	Basic School	١٤٦	٤٨.7
	High School	٧٦	٢٥,٣
	Diploma	31	١٠,٣
	Bachelor Degree and more	47	١٥,٧
	Total	300	١٠٠,٠
5.	**Marital Status**		
	Unmarried	81	27
	Married	٢١٩	73
	Total	300	١٠٠,٠
6.	**Department name**		
	Neurosurgery	١٣١	٤٣,٧
	Neurology	١٠٤	٣٤,٧
	Others	٦٥	٢١,٧
	Total	300	١٠٠,٠
7.	**Type of CT Examination**		
	Brain	166	55.3
	Spine	١٣٤	44.7
	Total	300	100

As illustrated in table 4.1, the majority of the sample ages are between 20 and 39 years which represent about 45.3% of the sample. The table also shows that 55% of the sample is males, and 45% from the sample are female. The table illustrates that 58.3% of the sample were from Gaza Governorate, 22% from north Governorate, 17% from Mid Zone Governorate, and only 2.6 of the sample were from Khanyounis and Rafah Governorates. The table also shows that 48.7% of the sample has a low level of education, 25.3% of the sample has a high school, 10.3% hold a diploma

degree, and 15.7% has a bachelor degree and more. Furthermore it is illustrated that the majority of sample there's marital status are married, which represent 73% from the sample.

Concerning the department that requests the CT scan, 43.7% of the requests were from neurosurgery department, 43.7% from neurology department, and 21.7% from other departments. And finally, the findings revealed that 55.3% of the sample CT scan requests were for brain and 44.7% for spine.

4.1.2 Expose for previous CT scan examination

Table 4.2: Questionnaire Participant's Responses in Relation to Had Previous CT scan Examination

No.	Items	Category	N	%	Valid %
1.	You have previous CT scans.	Yes	98	32.7	32.7
		No	202	37.3	67.3
		Total	300	100.0	100.0
2.	The times of previous CT scan.	Once	65	21.7	66.4
		Twice	17	5.7	17.4
		3 Times and more	16	5.3	16.2
		Total	98	32.7	100.0
3.	The type of examination which you have done.	Brain	43	14.35	43.9
		Spine	43	14.35	43.9
		Other	12	4.0	12.2
		Total	98	32.7	100.0

Table 4.2 denotes that 32.7% of the study participants exposed to previous CT scan examination and 67.3% did not. The table also shows that 21.7% of the participants had one previous CT scan examination, 5.7% two times and 5.3% three times and more. This table also denotes that 14.3% of the participants who had previous CT scan examination were brain, 14.3% were spine, and 4% were other examinations.

These findings indicate that approximately one third of the participants expose to previous CT scan examination so they increase of the accumulative dose radiation therefore increase the estimated risk for future cancer from current CT scan radiation. (González, 2009)

4.1.3 Knowledge of Radiation Risk

Table 4.3: Questionnaire Participant's Responses in Relation to Knowledge of Radiation Risk

No.	**Items**	**Category**	**N**	**%**
1.	The knowledge of harmful effects of x-ray radiation.	No	106	35.3
2.	The knowledge of the harmful effects of CT scan are double that of plain X-ray.	No	205	68.3
3.	The knowledge of repeated exposure to radiation may lead to cancer.	No	191	63.7
4.	Your physician inform you about the harms of x-ray radiation.	No	280	93.3
5.	Your doctor give you any flyers about harmful effects of x-ray radiation and CT scan.	No	299	99.7

As illustrated in table 4.3, about 35.3% of the study participants do not know the harmful effects of x-ray radiation. The table also shows that 68.3% of the participants don't know that the harmful effects of CT scan radiation are double that of plain x-ray radiations. In this table it is shown also that 63.7% of the participants don't know that the repeated exposure to radiation may lead to cancer. The table also shows that most of the physicians don't inform the patients about the harmful effects of the exposure to medical radiation where about 93.3% of the participants were not informed by their physicians about these harmful effects. Finally almost all the participants (99.7%) didn't get flyers from their physicians about the harmful effects of x-ray radiation. These findings illustrate that neither physicians nor patients do care for the harmful effects of medical radiation dose. In relation to these findings, key informants said that, due to the culture of the local population and the pressure upon the physician from the patients who think that the CT scan is the solution to their diseases.

4.1.4 Factors that affect the writing of CT scan request and examination

Table 4.4: Questionnaire Participants' Responses on the Factors Affecting the Writing of CT Scan Request and Examination

No.	Items	Category	N	valid%
1.	You asked your doctor to write the CT scan request.	Yes	92	30.7
2.	Your doctor wrote the CT request after a pressure from you or from one of your family.	Yes	70	23.3
3.	You have a previous relationship with your doctor or anyone of the medical staff.	Yes	124	41.3
4.	If yes, this is the cause for writing the CT request?	Yes	62	50.0
5.	you visited the doctor who wrote the request in his private clinic.	Yes	111	37.0
6.	You got the date of the examination through a relationship with any of the staff.	Yes	96	32.0
7.	You are satisfied with your appointment in the department.	Yes	199	66.3

As illustrated in table 4.4, the participants are not always asking their physicians to write CT scan request as about 30.7% of the sample asked their physicians to write a CT scan request, while 69.3% didn't. The table also shows that about 23.3% of the participants their physicians wrote the CT scan request after a pressure from them or from their family and 76.7% wrote the requests without any pressure. As shown in the table, about 41.3% of the participants have previous relationship with their physicians or with one of the medical staff and 58.7% of them do not have. This table also shows that about 50% of them said that the previous relationship with the physicians or with one of the medical staff was the cause for writing the CT scan request, and the same percentage said that it was not.

Also, it is shown in the table that about 37% of the participants visited their physicians in their private clinics and 63% didn't; about 32% of the participants got the date of the examination in the CT scan department through the relationships while 68% without any relationships. Finally the table shows that 66.3% of the participants are satisfied with the appointment in the CT department and only 33.7% are not.

These findings reveal that there are many factors that affect the writing of CT scan requests, and the factor with the highest percentage (41.3%) is the previous relationship between the participants and the health providers.

4.1.5 Questions related to CT spine examination

Table 4.5: Participants' Responses in Relation to spine CT Examination

No.	Items	Category	N	%
1.	The cause of .Spine CT scan examination.	L.B.P	29	21.6
		L.B.P and L.L	101	75.4
		Others	4	3.0
		Total	134	100.0
2.	You complain of neurological signs such as numbness in the lower extremities.	Yes	٩٠	67.2
		No	44	٣٢,٨
		Total	134	100.0
3.	You have had a plain X-ray of the spine before writing a request for CT.	Yes	99	٧٣,٩
		No	35	٢٦,١
		Total	134	100.0
4.	Your physician gave you a conservative treatment before writing a request for CT.	Yes	١٠٧	79.9
		No	٢٧	20.1
		Total	134	100.0
5.	You have had an E.M.G before writing a request for CT.	Yes	٤٤	٣٢,٨
		No	٩٠	٦٧,٢
		Total	134	100.0
6.	If the result of your examination is disc, you intend to do surgery to remove it.	Yes	51	٣٨,١
		No	83	٦١,٩
		Total	134	100.0
7.	If no, you informed your physician.	Yes	27	32.5
		No	56	67.5
		Total	83	100.0

The above table (4.5), shows that about 21.6% of the participants who examined for spine CT scan complain from low back pain (L.B.P) and 75.4% of them complain from LBP and lower limp (L.B.P and L.L); 32.8% of the participants who examined don't complain of neurological signs such as numbness in the lower limp and 67.2% of them do complain, also about 26.1% of the participants who examined for spine CT scan didn't have plain X-ray of the spine before writing a request for CT and 73.9% of them have done. The table shows that 20.1% of the participants who examined for spine CT scan their physicians didn't give them conservative treatment before writing a request for CT while 79.9% have given them. About 67.2% of the participants didn't have E.M.G before writing a request for CT scan and 32.8% of them have had; about 61.9% of the participants didn't intend to do surgery to remove the disc if the result of the examination is disc, while 38.1% of them intend to do the surgery. Finally the table shows that about 32.5% of the participants who didn't intend to do surgery to remove the disc have informed their physicians that they don't intend to do surgery and 67.5% didn't inform their physicians.

These findings indicate that the physicians do not always write the essential previous examinations before writing the CT scan request which leads to the increase in the number of unnecessary CT scan examinations and exposes the patients to an unnecessary medical radiation.

4.1.6 Questions related to CT brain examination

Table 4.6: Participants' Responses in Relation to Brain CT Examination

No.	Items	Category	N	%
1.	The cause of request brain CT scan examination.	Headache	103	62
		Dizziness	29	17.5
		Falling down	8	4.8
		C.V.A	6	٣,٦
		R.T.A	2	1.2
		Tumor	6	3.6
		Others	12	7.2
		Total	166	100.0
2.	You have any neurological signs.	Yes	٧٥	45.2
		No	91	٥٤,٨
		Total	166	100.0
3.	You have had skull or sinus X-ray.	Yes	68	41
		No	98	٥٩
		Total	166	100.0
4.	Your physician gave you a conservative treatment before writing the request for CT.	Yes	١٠٨	65.1
		No	٥٨	34.9
		Total	166	100.0
5.	You have had an E.E.G before writing a request for CT?	Yes	٤٠	٢٤,١
		No	١٢٦	٧٥,٩
		Total	166	100.0
6.	You have had funds examination before writing the request of CT.	Yes	69	٤١,٦
		No	97	٥٨,٤
		Total	166	100.0
7.	You have had middle ear examination before writing the request of CT.	Yes	29	17.5
		No	137	82.5
		Total	166	100.0
8.	You have had laboratory tests (blood test) before writing the request of CT.	Yes	١٢٠	72.3
		No	٤٦	27.7
		Total	166	100.0

As shown in table 4.6, about 62% of the participants who had brain CT scan complain from headache, 17.5% from dizziness, 4.8% falling down, 3.6% C.V.A, 1.2% R.T.A, and 3.6% the cause of request were tumor and 7.2% were other diseases. These findings indicate that the majority of the participants examined for brain CT scan complain from headache.

This table also shows that about 45.2% of the participants have had neurological signs while 54.8% have not, about 59% did not have skull or sinus X-ray before writing a request for CT scan while 41% of them did have and about 34.9% were not given a conservative treatment before writing a request for CT scan while 56.1% of them were given. The table also shows that 75.9% of the participants didn't have an E.E.G before writing the request for CT scan while 24.1% of them did have; 58.4% of the

participants didn’t have fundus examination before writing a request for CT scan while 41.6% did have; 82.5% of the participants didn’t have middle ear examination before writing the request for CT scan while 17.5% of them have had. Finally this table shows that 27.7% of the participants who were examined for brain CT scan didn’t have laboratory tests before writing a request for CT scan and 72.3% of them have had.

The above findings show that the physicians are not always writing the essential previous examination that are necessary to do before writing a brain CT scan request, even though, most of the examinations were due to headache leading to an increase in the number of unnecessary CT scan examinations and also increase the amount of radiation to the patients.

In the above three tables (4.4, 4.5, 4.6) the findings are consistent with what the key informants said that the pressure upon the physicians from the other health providers (recommended cases) affects the writing of CT scan request.

4.1.7 The satisfaction

Table 4.7: Participants' Responses in Relation to Their Satisfaction

No.	Items	Category	N	%
1.	You are satisfied with the service within the department.	Yes	226	75.3
		No	74	24.7
		Total	300	100.0

As illustrated in table 4.7, the majority (75.3) of the participants is satisfied with the services within the CT scan department and 24.7% of them are not. This finding indicates that the service within the CT scan department is good. Most of key informants satisfied with the services within the CT scan department.

4.2 Reviewing checklists for Brain CT scan requests

During the three month-period from beginning of June to the end of August, 2011, about 4,132 CT scans had been performed, of them 1,578 (39%) were brain CT scans. About 71% (1,129) of the brain CT scan requests were reviewed for the availability and completeness of CT scan request related to patient's demographic information, clinical data, name of hospital, department name, signature of physician and result of the examination.

4.2.1 Descriptive analysis of brain CT scan requests

4.2.1.1 Findings from identification data of brain CT scan requests

Table 4.8: Availability of Identification and Demographic Data in Brain CT Scan Request

S n.	Item		Percentage
1.	Date of request	Not documented	١٥,٢
2.	Name of patient	Not documented	٠,١
3.	Age of patient	Not documented	١١,٨
4.	Gender of patient	Not documented	٢٦,٩
5.	Address of patient	Not documented	44.9
6.	Place of request	Not documented	4.9
7.	Department	Not documented	25.2

Table 4.8 shows that 84.8% of requests dates were documented, while 15.2% were not documented and it shows also that approximately 100% of the patients' names were documented. About 88.2% of the patients' ages were documented, while 11.8% were not, and about 73.1% of the patients' gender was documented, while 26.9% was not. The table also shows that 55.1% of patient's addresses were documented, while 44.9% were not documented and in about 95.1% of the requests, the hospital name was documented, while 4.9% was not. Finally, the table illustrates that 74.8% of the requests, the department name was documented, while in 25.2% it was not documented. These finding revealed that the data are not completely documented

except for the patient's name which was documented for approximately 100%. This is consistent with what the key informants said that in relation to the identification and demographic data, they do not conform with the CT scan request because it is not clear, malformed and there are no uniform requests, while others key informants attributed this to the physicians' carelessness with these documentations.

4.2.1.2 Findings from clinical and medical data of brain CT scan requests

Table 4.9: Availability of Clinical and Medical Data in Brain CT Scan Requests

S n.	Item		Percentage
1.	Complain of patient	Not documented	4.7
2.	Initial diagnosis	Not documented	47.5
3.	Medical history	Not documented	44.4
4.	Physical examination	Not documented	30.8
5.	Previous examination	Not documented	90.6
6.	Signature of physician	Not documented	0.4

Table 4.9 shows that 95.3% of the patients' complaints were documented, while 4.7% were not, and it reveals that 52.5% of the initial diagnoses were documented while 47.5% were not. It also illustrates that 55.6% of the patients' medical histories were documented, while 44.4% were not. About 69.2% of the physical examinations were documented, while 30.8% were not, 9.4% of the previous examinations were documented, while 90.6% were not. Finally this table illustrates that 99.6% of physicians sign their examinations, while 0.4% didn’t sign. It is found that the high percentage of incomplete data for previous examination, initial examination and medical history are due to the same causes reported by the key informants including: the CT scan request not clear, malformed, no uniform requests and no space to write the clinical and medical information, while the others attributed this to the lack of qualifications of the physicians to write the CT scan requests and some of the physicians are irresponsible.

4.2.1.3 Descriptive socio demographic data of patient for brain CT scan requests

Table 4.10: Descriptive Socio Demographic Data of Patient for Brain CT Scan Requests

S n.	Item	Frequency	Valid percent
1.	**Age in years**		
	0-9	275	27.6
	10-19	١٤٥	14.6
	20-29	١٨٦	18.7
	30-39	١١٠	11.0
	40-49	٨٦	8.6
	50-59	٦٩	6.9
	60-79	١١٣	11.3
	80 and above	١٢	1.2
	Missing	133	
	Total	١١٢٩	100.0
2.	**Gender**		
	Male	642	56.9
	Female	487	43.1
	Total	١١٢٩	100.0
3.	**Address**		
	North	١١٩	18.9
	Gaza	٤١٧	66.3
	Mid zone	٨٥	13.5
	Khanyounis and Rafah	٨	1.3
	Missing	٥٠٠	
	Total	١١٢٩	100.0
4.	**Hospital name**		
	Shifa hospital	٨٧٣	81.1
	Shohadaa Alaqsa hospital	٥٨	5.4
	Kamal Odwan hospital	٥٤	5.0
	Pediatric hospitals	٦٧	6.3
	Others	٢٥	2.3
	Missing	٥٢	
	Total	١١٢٩	100.0

Table 4.10 shows that 27.6% of the patients with valid requests were less than 9 years of age, 14.6% from 10 to19 years, 18.7% from 20 to 29, 11.0% from 30 to 39, 8.6% between 40 and 49, 6.9% between 50 and 59 years, 11.3% between 60 and 79 and only 1.2% were 80 years and above. The table also shows that 56.9 % of the patients were males and 43.1% were female". Also it illustrates that 66.3% of the valid requests were from Gaza governorate, 18.9% from North Gaza, 13.5 from Mid Zone governorate and 1.2% were from south governorates. Moreover the findings reveal that 81.1% of the valid requests were from "Shifa hospital", 5.4% from "Shohadaa Alaqsa hospital", 5.0% from "Kamal Odwan hospital", 6.3% from pediatric hospitals, and 2.3% from other hospitals.

This finding reveals that most of the patients were from Gaza governorate and Shifa hospital, male patients were more than female patients. Also it reveals that the rate

for brain CT decreases with age to peak at the youngest age group of lower than 9 years with the exception of the age group between 20 and 29 where the increase in the rate is noticed. The rate of the patients of lower 9 years is 27.6% which is 2-3 times more than that of the age group 60 and above. This result means that infants and young children are the most group exposed to the radiation so this is very serious because the infants and young children are the most vulnerable group to the risk of radiation. The results of this study are not similar to those found in other studies conducted in Southern District of Israel (Sherf, 2010). It was found that the rate of brain CT increases with age and the age group 0-9 was the group of the least exposure to radiation. (Figure 4.1)

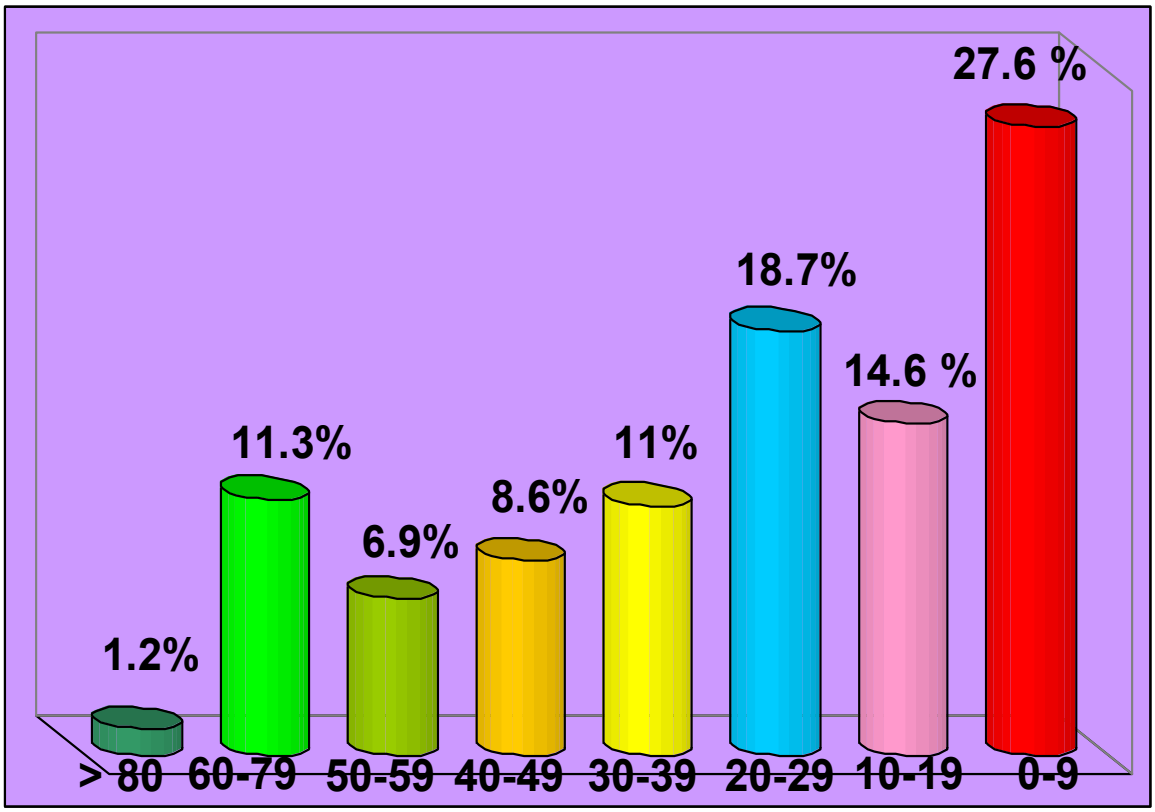


Figure (4.1) Distributions of brain CT scan patients according to their age

4.2.1.4 Descriptive clinical and medical data of patient for brain CT scan requests

Table 4.11: Descriptive clinical and medical data of patient for brain CT scan requests

S n.	Item	Frequency	Percent
1.	**Cause of examination**		
	Headache with neurological sign	160	14.2
	Headache without neurological sign	١٨٣	16.2
	Falling down	١٨٣	16.2
	Head trauma	١١٧	10.4
	Convulsion	١٠١	8.9
	C.V.A	١٧٤	15.4
	R.T.A	٤٤	3.9
	Post surgery	٢٢	1.9
	Tumor	15	1.3
	Atrophy or hydrocephalus	٦٩	6.1
	Meningitis	٨	0.7
	No cause	٥٣	4.7
	Total	١١٢٩	١٠٠,٠
2.	**Urgent or non urgent**		
	Urgent	616	54.6
	Non urgent	513	45.4
3.	**Name of department**		
	Neurosurgery	٤٤٩	39.8
	Neurology	٤٦٢	40.9
	Pediatric	١٢١	10.7
	Others	٩٧	8.6
	Total	١١٢٩	١٠٠,٠
4.	**Signature**		
	Physician	739	65.5
	Head of department	22	1.9
	Both	363	32.2
	No signature	5	0.4
		١١٢٩	100.0

Table 4.11 denotes that 14.2% of the patients complain from headache with neurological signs, 16.2% headache without neurological sign, 16.2% falling down, 10.4% head trauma, 10.4% complain from convulsion, 15.4% C.V.A, 3.9% R.T.A, 1.9% post surgery, 1.3% tumor, 6.1% atrophy or hydrocephalus, 0.7% meningitis, and 4.7% no cause of examination were noted. This result is similar to that of another study conducted in southern district of Israel (Sherf, 2010). The table also shows that 54.6 % of the patients were urgent cases and 45.4% were not. The table also denotes that 39.8% of the patients were from neurosurgery department, 40.9% from neurology department, 10.7% from pediatric departments and 8.6% from other departments. Finally the table shows that 65.5% of the requests were signed by physicians only, 1.9% signed by head of department only, and 32.2% were signed by both (physician

and head of department), and only 0.4% were not signed. In relation to the signature by the head of the department with the physician, key informants said that the head of department can't see the entire request done by the physicians and the specialist physician can write the request without signature of the head of department.

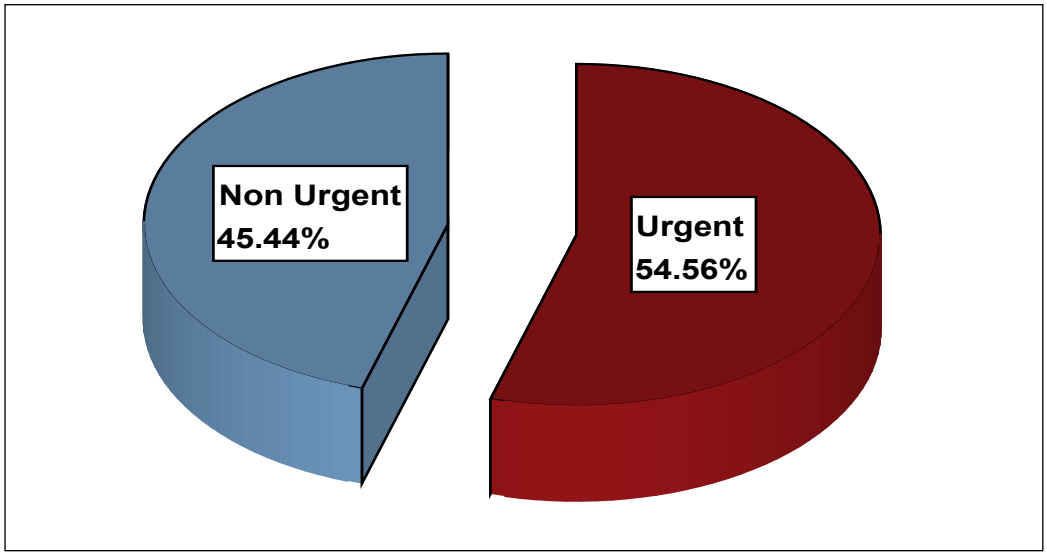


Figure (4.2) distributions of brain CT scan patients according to urgent or non urgent of brain CT scan requests

4.2.1.5 Results of brain CT scan examinations

Table 4.12: Results of Brain CT scan examinations

S n.	Item	N	%
1.	**Result of examination**		
	Negative	660	58.5
	Positive	٣٧٨	33.5
	No report	٩١	8.0
	Total	١١٢٩	١٠٠,٠

Table 4.12 shows the results of the Brain CT scans performed. In the majority (58.5%, 660 cases) of the patients, the results of the CT scans were completely normal, 33.5% of the results were abnormal, and 8.0% of the requests were found without reports. These findings are in agreement with the results of another study conducted in Southern District of Israel (Sherf, 2010), which found that 65.8% of the results in brain CT scan were normal. In relation to the results of examinations, key informant said that the normal result gives him an answer and the increase of the number of requests is due to pressure of patients and other health providers, and may be due to false negative from the radiologist or false negative from the CT scan machine.

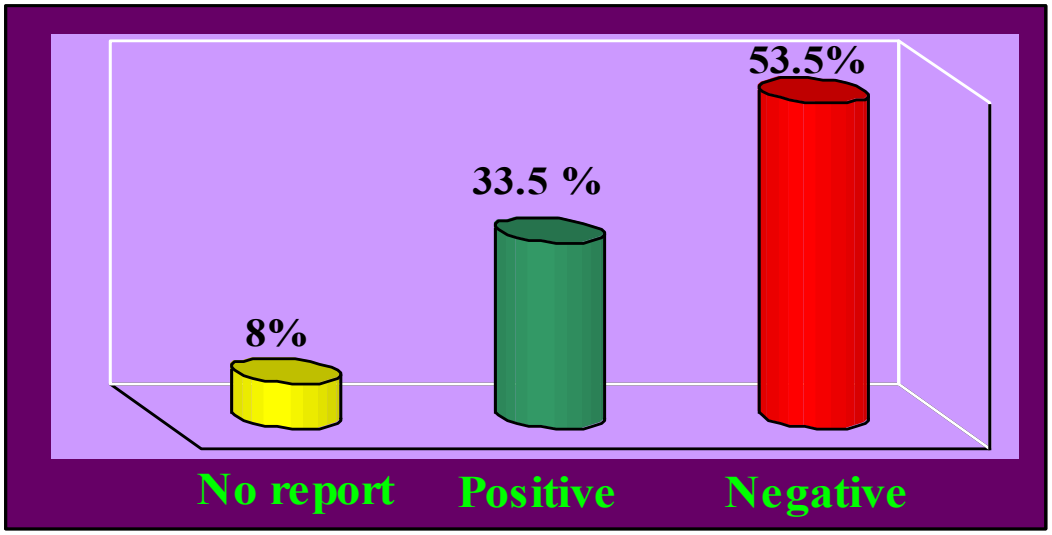


Figure (4.3) distribution of patients according to their result of brain examinations

4.2.1.6 Descriptive between results of Urgent and Non-urgent brain CT scan requests

Table 4.13: Descriptive Between Results of Urgent and Non-urgent brain CT scan requests

S n.	Result of examination	N	%
1.	**Urgent**		
	Negative	260	42.2
	Positive	269	43.7
	No report	87	14.1
	Total	616	100.0
2.	**Non urgent**		
	Negative	400	78.0
	Positive	109	21.2
	No report	4	0.8
	Total	513	100.0

Table 4.13 shows that the results of urgent and urgent requests as follow:

First: the results of urgent requests show that 42.2% were negative, 43.7% were positive, and 14.1% were with no report. Second: the results of non urgent request show that 78% were negative, 21.2% were positive, and 0.8% were with no report. These finding revealed that the majority (78%), of the results of non urgent CT scans requests were completely normal and key informant said that the increase of normal of the non urgent request due to the stress of patient and the result normal gives him an answer for the complain of the patients.

4.2.2 Inferential analysis of brain CT scan requests

In this section the researcher presents the differences in the finding of checklists in Brain CT scan requests in relation of the results of examination with gender, hospital, department, and type of request. In this study the researcher used the following statistical tools frequency and t-tests. A p-value of ≤0.05 is defined as statistically significant.

4.2.2.1 Results of brain CT scan examinations between departments at AL-Shifa hospital

Table 4.14: Results of Brain CT scan Examinations between Departments at AL-Shifa Hospital

S n.	Department	N	%
1.	**Neurosurgery**		
	Negative	209	49.5
	Positive	151	35.8
	No report	٦٢	14.7
	Total	422	100.0
2.	**Neurology**		
	Negative	259	68.9
	Positive	108	28.7
	No report	٩	2.4
	Total	376	100.0
3.	**Pediatrics**		
	Negative	9	50.0
	Positive	9	50.0
	No report	0	0.0
	Total	18	100.0
4.	**Other**		
	Negative	28	49.1
	Positive	22	38.6
	No report	7	12.3
	Total	57	100.0

Table 4.14 shows the results of examination from the different departments at Shifa hospital as follows:

First: the results from neurosurgery department show that 49.5% were negative, 35.8% were positive, and 14.7% were with no report.

Second: the results from neurology department show that 68.9% were negative, 28.7% were positive, and 2.4% were with no report.

Third: the results from pediatric department the table show that 50.0% were negative, 50.0% positive.

Forth: the results from other departments show that 49.1% were negative, 38.6% were positive, and 12.3% were with no report.

These findings revealed that neurology department have the highest percentage of negative examination (68.9%) and it is consistent with what the key informants said that most of neurological examination required from the neurological department which increases the likelihood of negative examinations in comparison to other departments as well as the psychological stress of patients who want to do CT scan examinations.

4.2.2.2 Results of brain CT scan examinations for urgent and non urgent requests among departments

Table 4.15: Results of Brain CT scan Examinations for Urgent and Non-urgent Requests among Departments

S n.	Department	Urgent		Non urgent		Sig
1.	Neurosurgery	Frequency	Percent	Frequency	Percent	
	Negative	144	42.5	73	66.4	0.001
	Positive	127	37.5	34	30.9	
	No report	٦٨	20.0	3	2.7	
	Total	339	100.0	110	100.0	
2.	**Neurology**					
	Negative	94	45.2	221	87.0	0.001
	Positive	106	51.0	32	12.6	
	No report	٨	3.8	1	0.4	
	Total	208	100.0	٢٥٤	100.0	
3.	**Pediatric**					
	Negative	6	33.3	70	68.0	0.001
	Positive	12	66.7	33	32.0	
	No report	0	0	0	0	
	Total	18	100.0	103	100.0	
4.	**Others**					
	Negative	16	31.4	36	78.3	0.001
	Positive	24	47.0	10	21.7	
	No report	11	21.6	0	0	
	Total	51	100.0	٤٦	100.0	

Table 4.15 displays the results of urgent and non urgent requests among the departments.

First: the results from neurosurgery department the show that, of the urgent examinations 42.5% were negative, 37.5% were positive and 20.0% was with no reports, while of the non urgent examinations 66.4% were negative 30.9% were positive, and 2.7% was not reported.

Second: the results from neurology department show that of the urgent requests 45.2% were negative, 51.0% were positive and 3.8% were with no reports, while of the non urgent requests 87.0% were negative 12.6% were positive, and 0.4% were with no reports.

Third: for the pediatrics department the results show that, 33.3% were negative, 66.7% were positive and 0.0% was with no report of the urgent examination, while 68% were negative 32% were positive, and 0.0% was with no report of the non urgent examination.

Forth: for the other departments the results show that, 31.4% were negative, 47.0% were positive and 21.6% were with no reports of the urgent examination, while 78.3% were negative 21.7% were positive of the non urgent examination.

These findings indicate that the majority of examinations requested by the neurosurgery department were urgent with 20.0% of them didn't have report because usually the patients have critical conditions and the physicians doesn't need a report in such urgent examinations. Also the neurology departments have the highest percentage of negatives in non urgent examination (87%) while the percentage decreases to (45.2%) in urgent examinations, and that may be due to the same causes reported by the key informants who said that most of the neurological examinations are requested from the neurological department. This increases the number of examinations and hence the likelihood of negative results in comparison to other departments as well as the psychological stress of patients who want to do CT scan examinations.

The table also shows, there is a relationship between the results for Urgent and Non-urgent of brain CT scan requests among the department (p value = 0.001). There are statistically significant differences between the results for Urgent and Non-urgent of brain CT scan requests among the department. This means that there is a departmental effect on the results for Urgent and Non-urgent of brain CT scan requests.

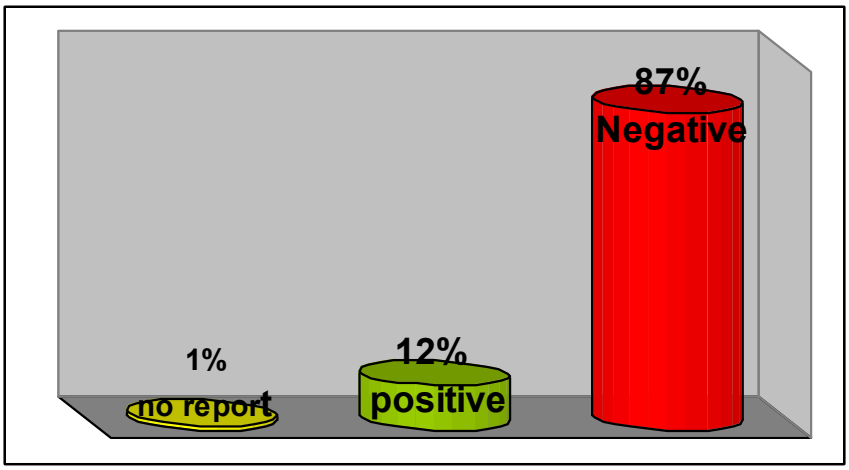


Figure (4. 4) Distribution of non urgent brain CT scan examinations according of result in neurology department

4.2.2.3 Results of brain CT scan Examinations according to gender

Table 4.16: Results of Brain CT scan Examinations According to Gender

S n.	Gender	Frequency	Percent
1.	**Male**		
	Negative	356	55.5
	Positive	218	34
	No report	68	10.5
	Total	642	100.0
2.	**Female**		
	Negative	304	62.4
	Positive	160	32.9
	No report	23	8.1
	Total	487	100.0

Table 4.16 shows that 62.4% of the female results of examinations were normal, while 55.5% of males' were normal, and the table also shows that 34% of male results of examinations have positive result while 32.9% of females were positive result.

These findings reveal that, the number of men diagnosed with brain pathology is higher than that of women. This result is not consistent with the findings of the study done in southern district of Israel (Sherf, 2010) which found that women are diagnosed with brain pathology at a significantly higher rate than men.

4.2.2.4 Relationship between departments and results of brain examination

Table 4.17: Differences among Departments According to Results of Brain Examinations

S n.	Department	Positive		Negative	
		N	%	N	%
1.	Neurosurgery	155	42.6	213	32.9
2.	Neurology	137	36.5	309	47.7
3.	Pediatric	40	11.9	66	11.5
4.	Others	33	9.0	44	7.9
Sig		0.001			

As shown in table 4.17, there is a relationship between the type of the department and the result of CT brain examination (X^2 =234.734 and p value = 0.001). There are statistically significant differences among the departments in the results of brain CT scan requests. This means that there is a departmental effect on results of brain CT scan requests; e.g. the neurology department has almost 50% of negative results, the neurosurgery department has about 43% of positive results.

4.3 Results from reviewing checklist for spine CT scan requests

In the three-month-period mentioned above 4,132 CT scans performed, of them 923 (22%) were spine CT scans. 651 (deductive rate 70%) of spine CT scan requests were reviewed for the availability and completeness of CT scan request related to patient's demographic information, clinical data, name of hospital, department name, signature of physician and the result of examinations.

4.3.1 Descriptive analysis of spine CT scan request

4.3.1.1 Findings from identification data in spine CT scan request

Table 4.18: Availability of Identification and Demographic Data in Spine CT scan Request

S n.	Item		Percentage
1.	Date of request	Not documented	25.0
2.	Name of patient	Not documented	0.2
3.	Age of patient	Not documented	12.4
4.	Gender of patient	Not documented	30.1
5.	Address of patient	Not documented	44.5
6.	Place of request	Not documented	6.5
7.	Department	Not documented	28.0

Table 4.18 shows that 75% of requests date were documented, while 25% were not documented and it shows also that approximately 100% of patient's name were documented. It also shows that 87.6% of patient's age were documented, while 12.4% were not documented and it shows that 69.9% of patient's gender were documented, while 30.1% were not documented. This table also shows that 55.5% of patient's address were documented, while 44.5% were not documented and 93.5% of patient's hospital name were documented, while 6.5% were not documented. Finally this table illustrates that 72% of patient's department name were documented, while 28% were not documented. These finding revealed that the data are approximately not completed except for patient's name which were documented for approximately 100% and it is similar to results of brain CT scan requests.

4.3.1.2 Findings from clinical and medical data in spine CT scan request

Table 4.19: Availability of Clinical and Medical Data in Spine CT scan Request

S n.	Item		Percentage
1.	Complain of patient	Not documented	10.0
2.	Initial diagnosis	Not documented	59.9
3.	Medical history	Not documented	65.1
4.	Physical examination	Not documented	45.3
5.	Previous examination	Not documented	91.6
6.	Signature of physician	Not documented	3.2

Table 4.19 illustrates that 90% of patient's complain were documented, while 10% were not documented and it revealed that 40.1% of patient's initial diagnosis were documented while 59.9% were not documented. It also illustrates that 34.9% of patient's medical history were documented, while 56.1% were not documented. Also it illustrates that 54.7% of patient's physical examination were documented, while 45.3% were not documented. This table also illustrates that 8.4% of patient's previous examination were documented, while 91.6% were not documented. Finally this table illustrates that 96.8% of physicians sign their examinations, while 3.2% only didn’t sign their examination. We found the high percentage of incomplete data both for previous examination, initial examination and medical history and these results are similar to results of brain CT scan requests.

4.3.1.3 Descriptive socio demographic data of patient for spine CT scan requests

Table 4.20: Descriptive Socio Demographic Data of Spine CT scan Requests

S n.	Item	Frequency	Valid percent
1.	**Age in years**		
	0-9	9	1.6
	10-19	45	7.9
	20-29	83	14.6
	30-39	145	25.4
	40-49	154	27.0
	50-59	86	15.1
	60-79	45	7.9
	80 and above	3	0.5
	Missing	81	
	Total	651	100.0
2.	**Gender**		
	Male	308	47.3
	Female	343	52.7
	Total	٦٥١	100.0
3.	**Address**		
	North	65	18.0
	Gaza	243	67.3
	Mid zone	50	13.9
	Khanyounis and Rafah	3	0.9
	Missing	290	
	Total	651	100.0
4.	**Hospital name**		
	Shifa hospital	515	84.4
	Shohadaa Alaqsa hospital	14	2.3
	Kamal Odwan hospital	68	11.1
	Pediatric hospitals	3	0.5
	Others	10	1.7
	Missing	41	
	Total	651	100.0

Table 4.20 shows that 84.4% of the valid requests from "Shifa hospital", 2.3% from "Shohadaa Alaqsa hospital", 11.1% from "Kamal Odwan hospital", 0.5% from pediatric hospitals, and 1.7% from others hospitals. The table shows also that 47.3 % from the patients are "Male", and 52.7% are "Female". This table illustrate that 1.6% from the valid requests ages "Less than 9 years", 7.9% between "10-19 years", 14.6% between "20-29 years", 25.4% between "30-39 years", 27.0% between "40-49 years", 15.1% between "50-59 years", 7.9% between "60-79 years", and only 0.5% from the ages "80 and above".

Moreover the findings reveal that 67.3% from the valid request from Gaza governorate, 18.0% from North governorate, 13.9 from Mid Zone governorate and only 0.9% are from south governorates. This finding revealed that most of patients

from Gaza governorate and Shifa hospital, female patients more than male patients, and finally revealed that the rate for spine CT increase with age to peak at the age group between 40-49 years after that decrease with age.

4.3.1.4 Descriptive clinical and medical data of patient for spine CT scan requests

Table 4.21: Descriptive Clinical and medical Data of Patient for Spine CT scan Requests

S n.	Item	Frequency	Percent
1.	**Cause of examination**		
	Low back pain	125	19.2
	Low bake pain with neurological sign	418	64.2
	Falling down	٣٠	4.6
	R.T.A	٥	0.8
	Post surgery	٦	0.9
	Tumor	٢	٠.3
	No complain noted	٦٥	10.0
	Total	651	100.0
2.	**Urgent or non urgent**		
	Urgent	70	10.8
	Non urgent	581	89.2
3.	**Name of department**		
	Neurosurgery	275	42.2
	Neurology	١٢٨	19.7
	Orthopedic	١٧٧	27.2
	Others	71	10.9
	Total	651	100.0
4.	**Signature**		
	Physician	445	68.4
	Head of department	15	2.3
	Both	170	26.1
	No signature	21	3.2
	Total	٦٥١	100.0

Table 4.21 denotes that 19.2% of the patients complain from L.B.P, 64.2% L.B.P with neurological sign, 4.6% falling down, 0.8% R.T.A, 0.9% post surgery, 0.3% tumor, , and 10% no complain noted. The table denotes also that 10.8% from the patients are "urgent patients", and 89.2% are "non urgent". This table also denotes that 42.2% of the patients from neurosurgery department, 19.7% from neurology department, 27.2% from orthopedic department and 10.9% from other departments. Finally it shows that 68.4% of the requests signed by physician, 2.3% signed by head of department only, 26.1% signed by both (physicians and head of department), and 3.2% only not signed by physicians. These finding revealed that L.B.P with neurological sign as numbness of lower limp represented the most percentage of patients complain, in relation to the signature of physicians on the request the results in accordance to brain results.

4.3.1.5 Results of spine CT scan examinations

Table 4.22: Results of Spine CT scan Examinations

S n.	Item	Frequency	Percent
1.	**Result of examination**		
	Negative	162	24.9
	Positive	485	74.5
	No report	4	0.6
	Total	٦٥١	100.0

Table 4.22 shows the results of the spine CT scans performed. In the majority of the patients the results of CT scan were positive result in 485 (74.5%) patients, 24.9% from the results were negative, and 0.6% from the requests found without reports. these results aren't similar to results of brain CT scan requests.

4.3.1.6 Results of spine CT scan examinations between departments at AL-Shifa hospital

Table 4.23: Results of Spine CT scan Examinations Between Departments at AL-Shifa Hospital

S n.	Department	Frequency	Percent
1.	**Neurosurgery**		
	Negative	65	26.2
	Positive	183	73.8
	No report	0	0.0
	Total	248	100.0
2.	**Neurology**		
	Negative	26	22.0
	Positive	92	78.0
	No report	0	0.0
	Total	118	100.0
3.	**Orthopedic**		
	Negative	34	32.1
	Positive	70	66.0
	No report	2	1.9
	Total	106	100.0
4.	**Others**		
	Negative	10	23.3
	Positive	33	76.7
	No report	0	0.0
	Total	43	100.0

Table 4.23 show: the results of spine examination from the departments at Shifa hospital which are:

First: the results from neurosurgery department the table shows that 26.2% were negative, 73.8% were positive, and 0.0% were with no report.

Second: the results from neurology department the table shows that 22% were negative, 78% were positive, and 0.0% were with no report.

Third: the results from orthopedic department the table shows that 32.1% were negative, 66% were positive, and 1.9% were with no report.

Forth: the results from other departments the table shows that 23.3% were negative, 76.7% were positive, and 0.0% were with no report.

These finding results revealed that orthopedic department have the highest percentage of negative examination (32.1%), while neurology department have the highest percentage of positive examination (78%), and it is consistent with what the key informants said that the neurological diseases related to neurological physician only and not others such as orthopedic physicians.

4.3.1.7 Results of spine CT scan examinations according to gender

Table 4.24: Results of Spine CT scan Examinations according to gender

S n.	Gender	Frequency	Percent
1.	**Male**		
	Negative	72	23.4
	Positive	234	76.0
	No report	2	0.6
	Total	308	100.0
2.	**Female**		
	Negative	90	26.2
	Positive	251	73.2
	No report	2	0.6
	Total	343	100.0

Table 4.24 shows that 26.2% of female their result of spine examinations were normal, while 23.4% of male were normal, and the table also shows that 76% of male their result of spine examinations were positive result, while 73.2% of female were positive result. These finding examinations revealed that men were diagnosed with spine pathology higher than women. This result is consistent with the findings of brain examinations.

4.4 Results from in-depth interview findings (qualitative data)

In-depth interviews were done with eight key informants at AL-Shifa hospital. It included the director generals of radiology and surgery, two from radiology department, two from neurosurgery department, and two from neurology department.

Description of work process

Upon asking the key informants the question regarding the description of work process, all of them said that the department serves large number of people (more than 1000,000 inhabitants of the Middle, Gaza and North Gaza governorates) which leads to a huge number of cases to be examined at the department. Although the work is running smoothly in a traditional way with pressure in work within the morning period, especially from the urgent cases during the day working hours, but in the evening and night period no pressure exists. Also the interviewees agreed that the appointment of waiting list is appropriate regarding the huge number of patients that the department serves; also they agreed that there is an absence of guidelines that regulate implementing standards protocols at the administrative level.

Common problems and challenges facing the key informants

All key informants agreed that the most common problems facing the work in the department is the breakdown of CT scan machine, absence of periodic maintenance of the machine, in addition to the shortage of spare parts for maintenance which leads to long period of breakdown of the machine. Also they agreed that there is a shortage of staff in the CT scan department. They also said that they noticed that there isn't appropriate coordination between and among departments, mainly in evening and night period which needs more attention, but the key informants in radiology department didn't agree with this and said that the problem is from other departments and physicians who export their problems to CT scan department.

Regarding the results of examinations

In regards to the results of most CT scan examinations as being normal, there wasn't a consensus among all the interviewed key informants. Some attributed it to the false negative from the radiologists or false negative from the CT scan machine, while others related it to the physicians who write the CT scan requests not according to the protocols and under the pressure exerted upon them from the patients. In addition, the physicians attempted to serve their patients and the health providers.

Criteria for writing a CT scan request

All the interviewed key informants said that there are criteria for writing CT scan request but it isn't implemented properly. There was a consensus among all of them that the barriers for implementing the criteria properly are related to pressure on the physicians who write the CT scan request from the relation with other health providers.

Pressure on physicians to write CT scan request

Regarding the question related to the pressure exerted on physician who writes the CT scan request, all the interviewed key informants agreed that there is a pressure exerted on the physician to write the CT scan request and the pressure is mainly from the relations with a colleague health provider and/or from the patient himself.

Inform the patient or his guardian about the risk of radiation exposure

Regarding the question if the physician informs the patient or his guardian about the risk of exposure to CT scan radiation, there wasn't a consensus among all of the interviewees. Those who said no attributed it to the ignorance and lack of knowledge of the physician about the risk of exposure to CT scan radiation while others related it to the culture of the patients and lack of trust between physicians and patients and in addition, some patients lie when asked if they were warned or not. And in regard to how the issue of informing be improved, they said by educational sessions for physicians mainly for pediatric physicians about the risk of exposure to CT scan

radiation and flyers about the risk of exposure to CT scan radiation to remind the physicians of this subject.

Factors affecting appropriate writing and documenting of the requests by physicians

In relation to this question, there wasn't a consensus among all of the interviewees; some of them related this to the lack of qualifications of the physicians to write the CT scan requests and that the physicians are irresponsible. Others attributed the inappropriateness and lack of documentation of the request to the physician being unconvinced to write the request because of the pressure exerted upon him. But, all of the interviewed key informants said that most of the request for CT scan was not clear, malformed, not uniformed and there is no enough space to write the clinical and medical information.

Barriers that impede the implementing of the CT scan protocols

With regard to the barriers that impede the implementation of the CT scan protocols, there were different opinions among the interviewees. Some of them said that it is due to lack of commitment from the committees about what has been a consensus upon, lack of follow up and lack of responsibility from the MOH. Others said that the barriers include lack of integrated system to regulate the work in the hospitals, the pressure from the patients due to their culture and the pressure from health providers that disrupt the application of the protocol. Finally one of them said that this is due to easy access to the CT scan examination.

Factors that promote and/or enhance the work in the CT scan department

The interviewed key informants have proposed some ideas and suggestions in order to promote and enhance the work in the CT scan departments such as:

- Creating an integral system to regulate the work in the hospital.
- Activate and well formulate the CT scan protocols.

- Initiate awareness campaigns of the public and the medical staff on the risks of radiation.
- Make special courses for those who write the request of CT scan.
- Ensure the sustainability of the CT scan machine through periodic maintenance and follow up.
- Continuously develop courses for the medical and technical staff of the CT scan department.
- Follow a policy of reward and punishment.
- Add more CT scan machines to meet the huge number of patients.
- Increase the number of the staff within the CT scan department to meet the ever increasing number of cases.

Regarding if such researches will help in improving health services

Most of key informants said that such researches will help in improving health services and that it is a great opportunity to take advantage of their results but there a need for a mechanism and a system to get the benefits of these researches. Some others said that such researches are not beneficial because they are not taken seriously and implemented by the MOH and that these researches only benefit their owners. But, all the key informants who were interviewed ask for the application of the results and recommendations of such researches.

Chapter 5: Conclusion and recommendation

This chapter presents the main conclusions of this study as well as some recommendations for decision makers that may help in adopting better utilization of CT scan at Al-Shifa hospital.

5.1 Conclusion

The rational use of neurological CT scan is necessary to protect the people from unnecessary medical radiation dose and it is the first step of controlling the utilization of CT scan. The main objective of this study is to assess the rational use of neurological CT scan and the main factors that affect the writing of CT scan requests in the CT scan department at Al-Shifa hospital. The study topic was selected due to the noticed increase in the utilization of neurological CT scan as a tool for disease diagnosis.

In this research the triangulated approach was used: first, structured questionnaire for the patients at the CT scan department (300 questionnaires); second, reviewing of 1129 requests of brain CT scans and 651 requests of spine CT scans and finally in-depth interview with eight stakeholders at Al-Shifa hospital.

During the three month-period from the beginning of June to the end of August, 2011, about 4,132 CT scans had been performed, of them 2501(61%) were neurological CT scans [1,578 (39%) were brain CT scans, and 923 (22%) were spine]. About 71% (1,129) of the brain and 70% (651) of the spine requests were reviewed for the availability and completeness of CT scan request related to patient's demographic information, clinical data, hospital name, department name, signature of physician and result of the examination.

The study results show that there are some problems regarding the documentation of clinical and medical data in the CT scan requests. These problems include: physicians do not always write the essential previous examinations before writing the CT scan request, multiple factors affecting the writing of CT scan request, the results of non urgent CT scan examinations. The most serious problem in this study is that most examinations of brain CT scans (27.6%) were for infants and young children which makes them as the highest group exposed to the radiation.

The study revealed that there are multiple factors that affect the decision to write CT scan requests. They include complex combination of considering patients or family request, anxiety of suffering patients, physician-patient relationship, visiting the physician in his private clinic, and many patients get the date of the examination in the CT scan department through the relationships. So there is a problem in writing the CT scan request regarding the recommendations from the patients or other health providers where 41.3% of the patients have had a previous relationship with one of the health providers in the hospital who usually intervene in the writing of the request.

The study findings also demonstrate that the majority (75%) of the patients (participants) were satisfied with the service at the CT scan department. Also about 66.3% of the patients were satisfied with the appointment in the CT department in spite of the fact that 32% got the appointment in the CT scan department through the relationships. Only 24.7% of the patients were unsatisfied due to long waiting list.

The study also indicates that in the brain CT scans, males represented 56.9% while in the spine CT scans, females represented 52.7%. The results also denote that the referral rate for brain CT increases with the decrease of age to peak at the youngest age group of 0-9 years which reflects a serious public health problem. While in the spine CT scans the rate increases with age to peak at age between 40 and 49 years then declines.

The study revealed that the indications leading to the referrals of brain CT include headache with or without neurological signs which represents the main reason in 31% of the patients, 16.2% falling down, 10.4% head trauma, 10.4% complaint of convulsion, 15.4% C.V.A, 3.9% R.T.A, 1.9% post surgery, 1.3% tumor, 6.1% atrophy or hydrocephalus, 0.7% meningitis and 4.7% no complaints were noted.

Regarding to the diagnosis of the performed brain CTs the majority (58.5%) of the patients were completely normal, 33.5% positive and 8% not reported. These results are compatible with previous literature, but the results found in the neurology department with non urgent brain CT scans contradict that in the literature where 87% were completely normal. Also this study denotes that 24.9% of the spine scans was completely normal.

And finally there are statistically significant differences in the results of brain CT scan requests among departments which mean that there are departmental effects on type of the result.

5.2 Recommendations

5.2.1 To the Ministry of Health and other healthcare providers:

- Conduct a training course on the benefits versus risks of CT scan radiation dose for the health providers.
- Conduct training course for physicians who write the requests of CT scans.
- Launch an awareness campaign for the public on the risks of medical radiation.
- Distribute flyers for risks of medical radiation to public.
- Create standard, uniform and clear CT scan request instead of the old malformed and unclear request.
- Activate the CT scan protocols and well formulate them.
- Create polices to control the work within and among the CT scan departments.
- Create an integral system to regulate the work in the hospital.
- Enhance the importance and respect of the MOH to the challenges facing the CT scan department and help the local team.
- Increase the CT scan machines to meet the ever increasing number of patients.
- Develop courses for the medical and technical staff on the CT scan use and hazards.
- Improve the quality in the CT scan department in order to inhibit the excessive radiation exposure to the patients, improve the quality outcomes and cost containment.
- Apply a promotion (incentives and rewards) system for the health providers who comply with the CT scan use protocols.

5.2.2 For further research

Other studies are needed to

- Assess the other non neurological CT scans examinations in CT scan departments at AL-Shifa hospital.
- Assess the other CT scan departments in Gaza Strip.
- Assess the magnitude of exposure for medical radiation dose in Gaza Strip.
- Evaluate the cost effectiveness of CT scans in Gaza Strip.

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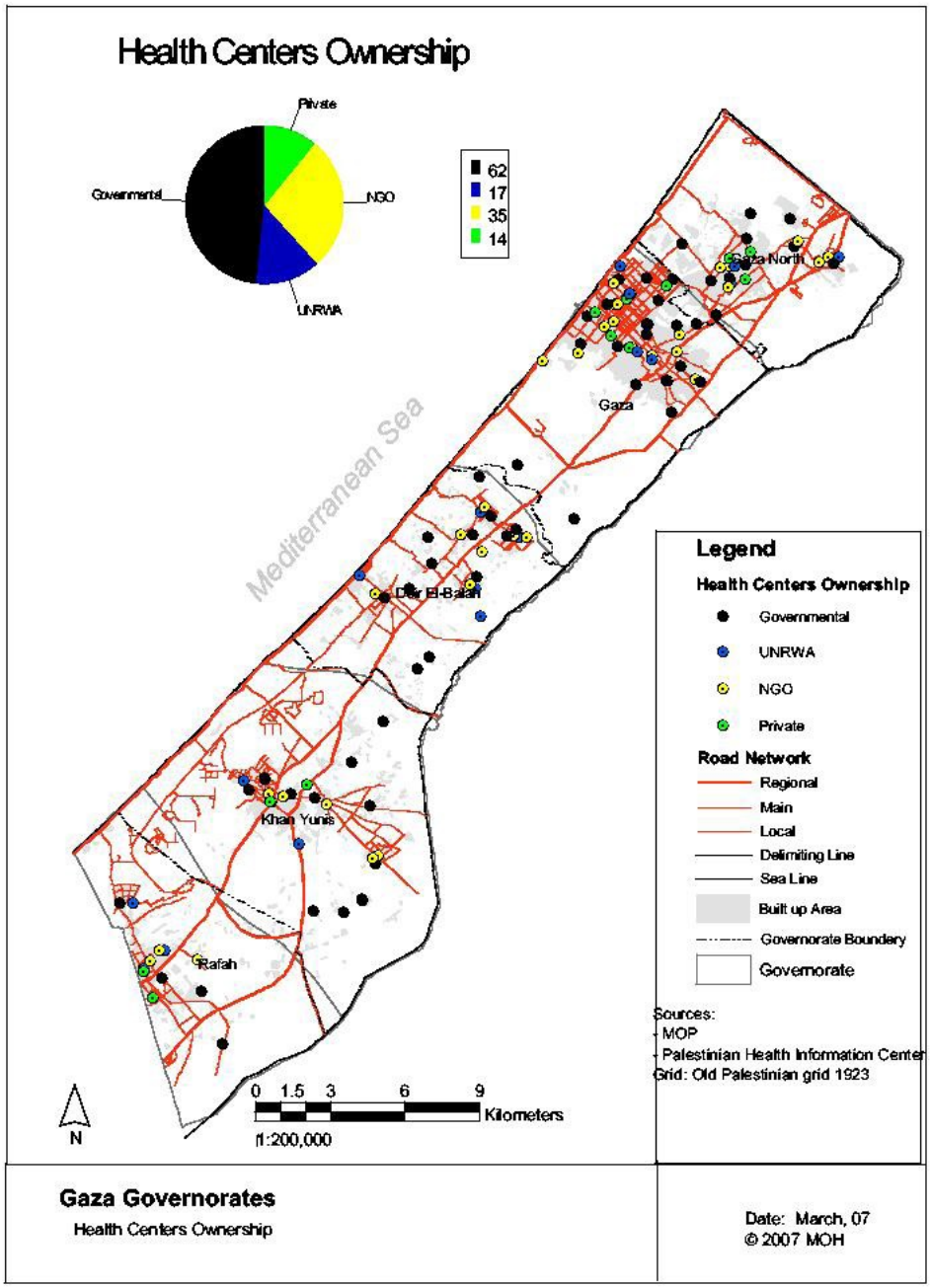
Annexes

Annex (1)

Map of Palestine

Annex (2)

Map of Health Centers in Gaza Governorates



Annex (3): Helsinki committee approval

Palestinian National Authority
Ministry of Health
Helsinki Committee

السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

التاريخ : **07/03/2011**

Name: **Abd Raziq Bairem**

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

" Rational use of Neurological computerized Tomography Scan conducted at Shifa Hospital."

الاسم: **عبدالرازق بيرم**

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

In its meeting on March 2011

and decided the Following:-

To approve the above mention research study.

و ذلك في جلستها المنعقدة لشهر 3 2011

و قد قررت ما يلي:-

الموافقة على البحث المذكور عاليه.

Signature
توقيع

Member
عضو

Member
عضو

Chairperson

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.

Annex (4): An official letter of request

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2011/6/25

حضرة الدكتور ناصر أبو شعبان المحترم
مدير عام تنمية القوى البشرية –وزارة الصحة
تحية طيبة وبعد،،،

الموضوع: مساعدة الطالب عبدالرازق بيرم

يقوم الطالب المذكور أعلاه بإجراء بحث بعنوان:

"Rational Use of Neurological Computerized Tomography Scan at Shifa Hospital"

كمتطلب للحصول على درجة الماجستير في الصحة العامة–مسار علم الأوبئة. و عليه نرجو التكرم للإيعاز لمن ترونه مناسب لتسهيل مهمة الطالب في جمع البيانات اللازمة من قسم الأشعة المقطعية بمستفى الشفاء التابع لوزارتكم الموقرة.
علماً بأن المعلومات ستكون متوفرة لدى الباحث و الجامعة فقط.

و اقبلوا فائق التحية و الاحترام،،،

د. بسام أبو حمد
منسق عام برامج الصحة العامة

نسخة:
- الملف

Jerusalem Branch/Telefax 02-24799234
Gaza Branch/telefax 08-2884422-2884411
Sphealth@admin.alquds.edu
فرع القدس/تلفاكس 02-2799234
فرع غزة/تلفاكس 08-2884422-2884411
ص.ب/51000-القدس

Annex (5)

Questionnaire

Date: / / 2011 Number ----------

(for the researcher)

Personal Data

Please tick × in the appropriate box:

1- Age ----------years.

2 - Gender: ☐ Male ☐ Female

3 – Address:

☐ North Gaza ☐ Gaza ☐ Mid Zone

☐ Khan Yunis ☐ Rafah

4 - Marital status:

☐ Unmarried ☐ married

5 - Education:

☐ Elementary School ☐ High School ☐ Diploma

☐ Bachelor ☐ post graduate

6 - Have you had previous CT scans?

☐ Yes ☐ No

If yes go to questions 7-8:

7 - How many times _____.

8 - The type of examination which you have done:

☐ Brain ☐ Spine ☐ other

9 - Did you know the harmful of x-ray radiation?

☐ Yes ☐ No

10 - Do you know that the harmful of CT scan is double?

☐ Yes ☐ No

11 - Did you know that repeated exposure to radiation may lead to cancer?

☐ Yes ☐ No

12 -Did your physician inform you about harmful of x-ray radiation?

☐ Yes ☐ No

13 - Have you got from your doctor or from any an official on flyers about harmful of x-ray radiation and CT scan:

☐ Yes ☐ No

14 - Did you ask your doctor to write CT scan request:

☐ Yes ☐ No

15 -Did your doctor write the CT request after pressure from you or from one of your family?

☐ Yes ☐ No

16 - Did you have previous relationship of your doctor or one of the medical staff?

☐ Yes ☐ No

17 - If yes, is this the cause for writing the CT request?

☐ Yes ☐ No

18 - Have you visited the doctor who wrote the request for you in his private clinic?

☐ Yes ☐ No

19 – Have you got the date of the examination in the department through the relationship?

☐ Yes ☐ No

20 - Are you satisfied with your appointment in the CT Department whether it is appropriate for your specific symptoms?

☐ Yes ☐ No

21 - The hospital released CT request:

☐ AL-Shifa ☐ Al-Aqsa Martyrs

☐ Kamal Aodwan ☐ Beit Hanoun

☐ El-dura ☐ EL-Nasser AL-Takhasosy

22 –The department released CT scan request:

☐ Neurosurgery ☐ neurology

☐ Other

23 – The patient conditions when he arrival at the CT department:

☐ On his feet ☐ on a chair ☐ on bed

24 - Type of test:

☐ Brain ☐ spine

25 - The reason for requesting CT scan:

☐ Diagnostic ☐ follow-up

Special questions related to the spine:

26 - The cause of CT scan examination (symptom and initial diagnosis):

☐ Low back pain only ☐ severe low back pain and lower limb

☐ Tumors ☐ post surgery ☐ others

27 - Have you had Plain X-ray of the spine before writing a request for CT?

☐ Yes ☐ No

28 - Does your physician give you conservative treatment before writing a request for CT?

☐ Yes ☐ No

29 – Have you had E.M.G before writing a request for CT?

☐ Yes ☐ No

30 - Do you complain of neurological sign such as numbness in the lower extremities?

☐ Yes ☐ No

31 -If the result of your examination is disc, do you intend to do surgery to remove it?

☐ Yes ☐ No

32-If yes, did you inform your physicians:

☐ Yes ☐ No

Special questions for brain CT

33 - The cause of CT scan examination:

☐ Severe headache ☐ constant headache ☐ R.T.A

☐ Dizziness ☐ tumors ☐ Fall from a high

☐ C.V.A ☐ sinusitis ☐ Follow up

☐ Others

34 - Do you have neurological signs?

☐ Yes ☐ No

35 - Have you had skull or sinus X-ray?

☐ Yes ☐ No

36 - Does your physician give you conservative treatment before writing a request for CT?

☐ Yes ☐ No

37 - Have you had E.M.G before writing a request for CT?

☐ Yes ☐ No

38 - Have you had fundus examination before writing the request of CT?

☐ Yes ☐ No

39 - Have you had middle ear examination before writing the request of CT?

☐ Yes ☐ No

40 –Have you had laboratory tests (blood test) before writing the request of CT?

☐ Yes ☐ No

41 - Are you satisfied from the service within the Department?

☐ Yes ☐ No

Annex (6 **A checklist for reviewing CT scan request**

		Yes	No
1.	Date of the request	□	□
2.	Name of the patient	□	□
3.	Age of the patient	□	□
4.	Age group 0-9 □10-19 □20-29 □30-39 □40-49 □50-59 □60-79 □80 and more		
5.	Gender of the patient	□	□
		□ Male	□ Female
6.	Address of the patient	□	□
	□ North Gaza □ Gaza □ Mid Zone □ Khan. □ Rafah		
7.	Requester name (Hospital)	□	□
	□ ALShifa □ ALAqsa □ Kamal Odwan □ Beit Hanoun □ ELDura □ ELNasser		
8.	Urgent request	□ Urgent	□ Un urgent
9.	Reason for ordering CT scan	□ Follow up	□diagnosis
10.	Initial diagnosis	□	□
11.	The cause of examination	□ Headache without neurological sign	
		□ Headache with neurological sign	□ Constant headache
		□ Falling down	□ R.T.A
		□ Head trauma	□ Tumor
		□ L.B.P	□ L.B.P and lower limb
		□ Post surgery	
12.	Patient's medical history	□	□
13.	Physical examination	□	□
14.	Previous examination	□ X ray	□ ultrasound
		□ EEG	□ EMG
		□ Others	
15.	CT scan request for	□ Brain	□ Spine
16.	The department	□	□
17.	□ Neurosurgery □ Neurology □ Pediatric □Orthopedic □ Others		
18.	Signature	□ physician	□ Head of department
19.	Result	□ Negative	□ Positive

Annex (7)

In-depth interview with stakeholders at AL Shifa hospital

Introduction

research and its purpose

1. How do you describe the work processes within and among CT scan department?

2. What are the common problems and challenges facing the work in CT scan department at AL Shifa Hospital?

3. Please explain why the results of most CT scan examinations are negative?
4. What are the criteria for writing CT scan request? Are they implemented appropriately?

5. Do physician write CT scan request based on pressure on them how explain?

6. Why the physicians don't inform the patients or their guardians about the risk of exposure to CT scan radiation mainly when they are infants or young patients? How informing could be better?

7. What are the factors that lead to prevent physician from documenting appropriately?

8. What are the barriers that impede the implementation of the CT scan protocols?

9. In your opinion, what are the factors that promote and/or enhance the work in the CT scan department at AL Shifa Hospital?

10. Do you think that such researches will help in improving health services?

Annex (8)

Arabic questionnaire

استبيان

بسم الله الرحمن الرحيم

جامعة القدس

كلية الصحة العامة

برنامج ماجستير الصحة العامة– مسار وبائيات

عنوان البحث: الاستخدام المنطقي للأشعة المقطعية للحالات العصبية (الدماغ والعمود الفقري) في مستشفى الشفاء:
الإخوة و الأخوات الأعزاء:

هذه الدراسة يقوم بها الباحث كمتطلب للحصول على درجة الماجستير- مسار وبائيات بجامعة القدس أبو ديس كلية الصحة العامة.

يشكر الباحث لكم حسن المشاركة في هذه الدراسة من خلال الإجابة على أسئلة الاستبيان والتي لا تستغرق اكثر من ١٥ دقيقة من وقتكم الثمين وان مشاركتكم تسهم في إنجاح هذه الدراسة.

يود الباحث التأكيد على أن المعلومات ستبقى سرية و لهدف البحث العلمي لذلك لا داعي لذكر الأسماء
علما بأنه من حق المريض الامتناع عن إجابة أي سؤال أو رفض المشاركة.

شكرا لكم على المشاركة

الباحث عبد الرازق عبد القادر بيرم
مستشفى الشفاء-مركز الأمير نايف
جوال-٠٥٩٩٥٢٧٧٤٦

Research title: Rational Use of Neurological CT scan at AL-Shifa Hospital

عنوان البحث: الاستخدام المنطقي للأشعة المقطعية للحالات العصبية (الدماغ والعمود الفقري) في مستشفى الشفاء

التاريخ: / / 2011 الرقم ----------

(خاص بالباحث)

البيانات الشخصية

من فضلك ضع إشارة × في المربع المناسب :

١-العمر----------سنة.

٢-الجنس: ☐ ذكر ☐ أنثى

٣-العنوان:

☐ محافظة الشمال ☐ محافظة غزة ☐ محافظة الوسطى

☐ محافظة خان يونس ☐ محافظة رفح

٤-الحالة الاجتماعية:

☐ أعزب/ آنسة ☐ متزوج/ ة

☐ أرمل/ ة ☐ مطلق/ ة

٥- المستوى العلمي:

☐ أقل من ثانوية عامة ☐ ثانوية عامة

☐ دبلوم سنتين بعد الثانوية العامة ☐ بكالوريوس ☐ دراسات عليا

٦-هل تعرضت للأشعة المقطعية قبل ذلك:

☐ نعم ☐ لا

إذا كانت الإجابة نعم انتقل الى السؤال ٧-٨

٧- كم عدد المرات _____

٨-نوع فحص الذى قمت به:

☐ دماغ ☐ عمود فقرى

☐ غير ذلك

٩-هل تعلم بأضرار الأشعة:

☐ نعم ☐ لا

١٠-هل تعلم بأن أضرار الأشعة المقطعية مضاعفه:

☐ نعم ☐ لا

١١- هل تعلم أن تكرار التعرض للأشعة قد يؤدى إلى الإصابة بالسرطان:

☐ نعم ☐ لا

١٢-هل أعلمك طبيبك بأضرار الأشعة:

☐ نعم ☐ لا

١٣-هل حصلت من طبيبك أو من أي جهة على نشرة عن أضرار الاشعه المقطعية :

☐ نعم ☐ لا

١٤-هل طلبت من الطبيب كتابة فحص الأشعة المقطعية:

☐ نعم ☐ لا

١٥-هل كتب الطبيب الفحص بعد ضغط منك ومن أحد من عائلتك أو احد من أصدقاءك:

☐ نعم ☐ لا

١٦-هل لك معرفة سابقه بطبيبك أو بأحد من العاملين بالمجال الطبي:

☐ نعم ☐ لا

١٧-إذا كانت الإجابة نعم هل هي السبب في كتابه الفحص:

☐ نعم ☐ لا

١٨-هل قمت بزيارة الطبيب الذى كتب الفحص في عيادته الخاصة:

☐ نعم ☐ لا

١٩-هل حصلت على موعد الفحص بالقسم بالواسطة:

☐ نعم ☐ لا

٢٠-هل أنت راضى عن ميعادك فى القسم:

☐ نعم ☐ لا

٢١-المستشفى الذى صدر منه طلب الأشعة المقطعية:

☐ الشفاء ☐ شهداء الأقصى

☐ كمال عدوان ☐ بيت حانون

☐ النصر التخصصي ☐ الدرة

٢٢-مكان صدور طلب الأشعة المقطعية:

☐ قسم جراحة الأعصاب ☐ قسم باطنه أعصاب

☐ أخرى

٢٣-حال المريض عند وصوله لقسم الأشعة المقطعية:

☐ على قدميه ☐ على كرسي

☐ على سرير

٢٤-نوع الفحص:

☐ دماغ ☐ عمود فقرى

٢٥-سبب طلب الأشعة:

☐ تشخيص ☐ متابعة

أسئلة خاصة لتصوير العمود الفقري:

٢٦- سبب التصوير (الأعراض والتشخيص المبدئي):

☐ ألم في الظهر فقط ☐ ألم شديد في أسفل الظهر والأطراف السفلى

☐ بعد عملية جراحية ☐ أورام

☐ أخرى

٢٧-هل قمت بتصوير أشعه عاديه للعمود الفقري:

☐ نعم ☐ لا

٢٨-هل قام الطبيب بإعطائك أدوية علاجيه قبل كتابه طلب الأشعة المقطعية:

☐ نعم ☐ لا

٢٩-هل قمت بعمل تخطيط أعصاب(عضلات) قبل كتابه طلب الأشعة المقطعية:

☐ نعم ☐ لا

٣٠-هل تشعر بأعراض وآلام أعصاب مثل خذل وتنميل في الأطراف:

☐ نعم ☐ لا

٣١--في حال تبين وجود غضروف هل تنوى عمل عمليه جراحيه لاستئصال الغضروف

☐ نعم ☐ لا

٣٢-إذا كانت الإجابة لا هل أعلمت طبيبك بذلك:

☐ نعم ☐ لا

أسئلة خاصة لتصوير الدماغ

٣٣- سبب التصوير (الأعراض والتشخيص المبدئي):

☐ صداع شديد ☐ صداع مستمر ☐ حوادث مرور

☐ دوخه وعدم اتزان ☐ أورام ☐ سقوط من علو

☐ جلطه-نزيف ☐ أخرى

٣٤-هل يوجد عندك علامات لمشاكل عصبية أو عصبية مركزية:

☐ نعم ☐ لا

٣٥-هل قام طبيبك بتصويرك أشعه عاديه للرأس أو الجيوب قبل كتابة الأشعة المقطعية:

☐ نعم ☐ لا

٣٦-هل قام الطبيب بإعطائك أدوية علاجيه قبل كتابه طلب الأشعة المقطعية:

☐ نعم ☐ لا

٣٧- هل قمت بعمل تخطيط دماغ قبل كتابه طلب الأشعة المقطعية:

☐ نعم ☐ لا

٣٨-هل قمت بفحص قاع العين قبل كتابة طلب الأشعة:

☐ نعم ☐ لا

٣٩- هل قمت بفحص الأذن الوسطى قبل كتابة طلب الأشعة:

☐ نعم ☐ لا

٤٠- هل قمت بعمل فحوصات مخبريه (تحليل دم) قبل كتابة طلب الأشعة:

☐ نعم ☐ لا

٤١-هل أنت راضى عن الخدمة داخل قسم الأشعة المقطعية:

☐ نعم ☐ لا

Annex(9)

Request for evaluation and controlling questionnaire

استمارة تحكيم

السيد / د.....المحترم

تحية طيبة وبعد:

الموضوع تحكيم استبانه

يقوم الباحث بإجراء دراسة ميدانية بعنوان:

" Research title: Rational Use of Neurological CT scan at AL-Shifa Hospital "

و ذلك لاستيفاء متطلبات الحصول على درجة الماجستير في الصحة العامة- مسار وبائيات في كلية الصحة العامة بجامعة القدس.

إن خبرتكم الطويلة في هذا المجال و ثقة الباحث بكم جعلته يضع الاستبانة المرفقة بين أيديكم لأجل الوقوف على صحة ودقة فقراتها و كذلك مدى صلاحيتها و ملائمتها و يتطلع الباحث إلى ملاحظاتكم وآرائكم القيمة التي ستكون ذات تأثير كبير في إخراج الاستبانة بشكل يتسم بالمنهجية وتحقيق الأهداف المرجوة منها, و ذلك بإجراء تعديلات أو إضافات أو ملاحظات ترونها مناسبة و تثري هذه الاستبانة.

مرفق أهداف البحث.

شاكرين لكم حسن تعاونكم

و تفضلوا بقبول فائق الاحترام و التقدير

الباحث

عبد الرازق بيرم

Annex (10)

Names of experts

1. Dr. Bassam Abu Hamad	Al- Quds University
2. Dr. Yehia Abed	Al- Quds University
3. Dr. Yousef Abu Safieh	Al- Quds University
4. Dr. Sami ALAgha	AL-Azhar University
5. Mr. Yaseser ALAjramy	AL-Azhar University
6. Dr. Kamal Jaber	MOH, Head of radiological department
7. Dr. Raeid ALjzar	MOH, General director of Prince Naeif Center
8. Dr. Mohammad Alganoa	MOH, Head of radiotherapy department
9. Dr. Eed Abu Smaan	MOH, Head of CT scan department
10.Mr. Adel Abu Sultan	MOH, Head of CT scan department

استخدام المنطقي للأشعة المقطعية للحالات العصبية (الدماغ والعمود الفقري) في مستشفى الشفاء

إعداد: عبد الرازق عبد القادر إبراهيم بيرم

إشراف: د. يوسف أبو صفية

ملخص الدراسة:

في السنوات الأخيرة ازداد استخدام التصوير بالأشعة المقطعية المحوسبة في قطاع غزة بشكل كبير, وهذا يعكس تحسن القدرة التشخيصية للأشعة المقطعية. ومع ذلك يجب التخفيف من استخدامه لأنه يعرض المرضى لكمية كبيرة من الإشعاع فضلا عن التكاليف وقائمه انتظار طويلة من المرضى. إن الزيادة في أعداد مرضى الدماغ والعمود الفقري ظهرت منذ نشأة قسم الأشعة المقطعية بمستشفى الشفاء وما زالت من اكبر المشاكل التي تواجه العمل في القسم, وبالتالي فإن الاستخدام المنطقي للأشعة المقطعية هو هدف كل مقدمي الخدمة الصحية في قسم الأشعة المقطعية وإدارة قسم الأشعة، هذا وقد هدفت هذه الدراسة إلى تقييم الاستخدام المنطقي للأشعة المقطعية للحالات العصبية (الدماغ والعمود الفقري) في قسم الأشعة المقطعية بمستشفى الشفاء، وذلك للتقليل من خطر تعرض المريض للإشعاع الطبي وتقليل عبء النفقات المالية على المريض وعلى وزارة الصحة.

تم الاعتماد على دراسة ثلاثية تعتمد على الوصف الكمي والكيفي المقطعي من اجل تقييم الاستخدام المنطقي للأشعة المقطعية للحالات العصبية (الدماغ والعمود الفقري) في قسم الأشعة المقطعية بمستشفى الشفاء. لقد تم جمع المعلومات باستخدام ٣٠٠ استبانه للمرضى الذين تم فحصهم في قسم الأشعة المقطعية ومراجعة ١٧٨٠ طلب أشعة مقطعية باستخدام استمارة استخلاص لمعرفة مدى توافر واكتمال هذه الطلبات, هذا بالإضافة إلى عمل مقابلات معمقة مع ثمانية من أصحاب القرار في مستشفى الشفاء. مدة الدراسة كانت من ١-٦-٢٠١١ وحتى ٣١-٨-٢٠١١ حيث كان عدد طلبات الأشعة المقطعية للدماغ والعمود الفقري حوالي ٢٥٠١ طلب وجد منها ١٧٨٠ طلب أشعة فكان معدل وجود هذه الطلبات ٧١٪. جمع البيانات وعمل المقابلات تمت من قبل الباحث.

بينت نتائج الدراسة إن هناك عدة عوامل تؤثر على قرار الأطباء في كتابة طلبات الأشعة المقطعية, وهي مزيج معقد إذا أخذنا بعين الاعتبار حالة المرضى وعائلاتهم وعلاقة المرضى مع مقدمي الخدمة الصحية، وتبين أن معظم الأطباء لا يقومون بكتابة التشخيص المبدئي والتاريخ المرضى في طلبات الأشعة المقطعية، أيضا بينت الدراسة أن ٩٠٪ من المرضى لم يقوموا بعمل فحوصات سابقة ضرورية قبل القيام بتصوير الأشعة المقطعية. وأظهرت النتائج أيضا عدم وجود طلب واضح وموحد والذي بدوره يؤثر على كتابة الطلب. هذا وقد أظهرت النتائج أنه تم عمل ٢٥٠١ فحص أشعة مقطعية للحالات العصبية منها ١١٢٩ فحص للدماغ تم مراجعتهم وتبين أن نسبه الذكور تمثل ٥٧٪ من المرضى، ولوحظ أن أكثر سبب لطلب فحص الدماغ كان للمرضى الذين يعانون من الصداع وكانت النسبة حوالي ٣١٪ ونسبة الحالات العاجلة شكلت حوالي ٥٥٪ ، وكانت نسبة النتائج الطبيعية للفحوصات حوالي ٥٥٪ وهى عالية نسبيا. أما بالنسبة لأعمار المرضى فان التعرض للإشعاع يقل مع زيادة العمر وهذا مؤشر خطير فأن الفئة العمرية من ٠-٩ سنوات تعرضت للأشعة بمعدل اعلي من الفئات العمرية

الأخرى وكانت نسبتهم ٢٨٪ من مرضى الدماغ, وهذه تمثل مشكلة خطيرة لان هذه الفئة أكثر فئة هشة للتعرض للإشعاع.
أظهرت نتائج مراجعة ٦٥١ طلب فحص للعمود الفقري أن نسبه الذكور تمثل ٤٧٪ من المرضى، ولوحظ أن أكثر سبب لطلب فحص العمود الفقري كان للمرضى الذين يعانون من ألم أسفل العمود الفقري والأطراف السفلى وكانت النسبة حوالي ٦٤٪ ونسبة الحالات العاجلة كانت ١١٪ ، وكانت نتائج الفحوصات طبيعية بنسبة ٢٥٪. أما بالنسبة لأعمار المرضى فان الفئة العمرية من ٤٠-٤٩ سنه تعرضت للأشعة بمعدل اعلي من الفئات العمرية الأخرى وكانت نسبتهم ٢٧٪ من مرضى العمود الفقري.

وخلص الباحث من نتائج الدراسة بأنه لا يوجد معايير واضحة لكتابة طلب الأشعة المقطعية ويجب على الطبيب أن يقوم بفحص المريض سريريا بصورة أفضل مع الأخذ في الاعتبار عدة عوامل مثل العلاقة بين المرضى ومقدمي الخدمة الصحية وكذلك علاقة الطبيب بالمريض.

يوصى الباحث بالتالي: وضع بروتوكولات بمعايير سليمة من اجل تحسين نوعية خدمات الرعاية الصحية، استحداث طلب أشعة موحد وواضح وكامل، إجراء دورات تدريبية لمقدمي الخدمات الصحية لشرح الفوائد مقابل المخاطر للأشعة المقطعية،إجراء دورات تدريبيه للأطباء الذين يكتبون طلبات الأشعة المقطعية على كيفية توثيق هذه الطلبات، وأخيرا يوصى الباحث بإطلاق برامج لتوعية الجمهور من مخاطر الأشعة الطبية.