Deanship of Graduate Studies
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Towards standardization and development of medical imaging protocols and referral requests in the Palestinian health system

Laith Abd Al-Fatah Shehdah Jaradat

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Prapared by:

Laith Abd Al-Fatah Shehdah Jaradat

B.Sc. Medical Imaging, AlAhliya University. Palestine

Supervisor : Dr. Mohammad Hjouj

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Prepared by: Laith Abd Al-Fatah Shehdah Jaradat

Registration No: 22112590

Supervisor: Dr. Mohammad Hjouj

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

1- Head of Committee	Dr. Mohammad Hjouj	signature	
2- Internal Examiner	Dr. Hussein ALMasri	signature	
3- External Examiner	Dr. Samer Mhanna	signature	

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Dedication

Thank you, God my prayer and gratitude to you. You are the one who gave me the power to work hard and continue despite the obstacles until I reached this high and great status

faith jaradat

الإهداء

الحمدلله حمد الشاكرين الذاكرين اهدي عملي هذا:

الى من كانوا السند الاول لي والى ما وصلت اليه الان

الى من حصد الأشواك عن دربي ليمهد طريق العلم لي والدي العزيز والى من أرضعتني الحب والحنان وبلسم الشفاء والدتي الحبيبة امي وابي اطال الله في عمرهم وحفظهم من كل مكروه

إلى القلوب الرقيقة والنفوس البريئة اخوتي الغالين على قلبي فشكراً من القلب لكم جميعاً

كما أتوجه بالشكر والامتنان إلى مشرفي العزيز الذي وقف معي طوال الوقت الدكتور محمد الحجوج له مني خالص التقدير والاحترام

وإلى الدكتور حسين المصري والدكتور سامر مهنى حفظهما الله ورعاهما وأطال في عمرهما

الى اصدقائي وزملائي الى كل من رافقني في ذلك الطريق

Declaration

I certify that this thesis was submitted for the degree of masters. It is the result of my own research, except where otherwise is acknowledged. I also certify that this thesis (or any part of the same) has not been submitted for any other university or institution.

Name: Laith Abd Al-Fatah Shehdah Jaradat

Signed: *laith jaradat*

Date: 18 / 3 /2024

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Abstract:

Introduction : Medical imaging plays a pivotal role in healthcare, especially in the field of diagnostic radiology where imaging procedures are used to diagnose monitor, and follow-up diseases. In this process, medical imaging technologists (MIT) play a crucial role in assessing and evaluating patients' conditions, Diagnostic or interventional medical imaging procedures involve interconnected elements, wherein the clinical-anamnestic evaluation and justification for the examination provide essential information for therapy, Assigning protocols for authorized advanced medical imaging (CT, MRI, NM) is a vital but often overlooked task in medical imaging departments workflows, Acquiring additional clinical details, including allergy, laboratory, and medication information, is often complex, requiring multiple interactions across systems, In the Palestinian health system (Public, private, NGOs) hospitals and health centers, various medical imaging protocols are employed.

The aim of the study: is to examine and evaluate protocols for advanced medical imaging services within the Palestinian health system due to the lack of a consistent standard across the country, Propose an initial standard criteria for advanced medical imaging procedures

Method : In order to address the study's objectives, which highlight the absence of standardization in medical imaging protocols and referral requests within the Palestinian health system, the researcher developed a questionnaire comprising 35 items, The questionnaire items were categorized into three domains: Protocols of medical imaging services, Position of medical imaging technologist, and Referral Requests Protocols, A Quantitative Descriptive and Analytic Methodology used in this research, Following the collection of distributed questionnaires, the researcher processed the data for analysis, Respondents' answers to questionnaire items were recoded into numeric values, with a value of 1 assigned to "Yes," 2 to "No," and 3 to "Don’t know.“ and the target population of this study includes all radiologists and MITs working in the Palestinian health system, The study sample was randomly selected and consisted of 235 radiologists and MITs working in the Palestinian health system, most of whom were male (72.3%), while the percentage of females was (27.7%), Most participants in the study sample were medical imaging technicians (80.9%), only 6.4% were consultant radiologists and 12.8% were radiology residents.

Result : The results revealed a deficiency in diagnostic and therapeutic standardized protocols for all procedures by 75.7%, Uniform implementation of protocols was not ensured, and deviations were not monitored, at a rate of 70.6%, No clear job description defining the roles and responsibilities of staff in managing image acquisition, and image quality accounting for 71.9%, The Medical Imaging Department lacks a Radiation Protection and Safety Officer (RSO) by 72.8%, Explanation and guidance on the imaging procedure were not provided to the service recipient before the procedure (65.1%), Patient safety lacks priority (65.5%), The quality of images is not verified by trained radiology and imaging staff,(65.5%), Safety checks before entering medical imaging procedures not consistently conducted (62.6%), Continuous

monitoring of unconscious, or sedated service recipients during the procedure is not ensured (62.6%) and the referral request by the referring physician doesn't include the relevant clinical information and history (68.5%), there is no a documented procedure for urgent and unexpected emergency patients (68.9%), billing information is not documented, or displayed, prior to the examination (68.1%), the referral request doesn't include explanation for female safety (66.8%), Medical and treatment information was not linked to previous relevant clinical, laboratory, and radiological details in the referral report (65.1%).

Conclusion: The findings of the current study indicate a significantly higher percentage of negative attitudes (No answers) towards referral request protocols in the Public Health sector (Medical Centers or Hospitals) compared to both NGOs, and Private sectors

Recommendations : Standardizing medical imaging protocols within the Palestinian health system is recommended, along with ensuring consistent implementation of these protocols and monitoring for any deviations, It is suggested that referral requests include standardized criteria for patient information.

Chapter One:

1.1 Introduction

Medical imaging is now an integral part of the whole continuum of health care, physicians did not have access to radiographs of what was going on inside the body of A patient until November. 8, “1895”. On that day (Wilhelm Conrad Roentgen) found a new kind of ray when testing with a Crookes cathode ray tube that he called x-rays. Since “x-ray” absorption depends on density, the hand of Bertha was the first and most famous x-ray image in history, Wife of Roentgen. The discovery of Roentgens set in motion a medical diagnostic. The revolution which is going on to this day. (Eyal, et al 2018) (Panchbhai, et al , 2015)

Diagnostic radiology is the branch of medicine that uses imaging tests and procedures to identify diseases and anomalies as a component of the treatment strategy. Any type of medical treatment that involves diagnosing illness or injury relies heavily on diagnostic radiography. Additionally, radiation is used in the research to create fully anatomical images at safe radiation levels (Diagnostic Radiology, 2020).

The diagnostic radiology approach, with its focus on diagnosis, exemplifies a partnership between the radiology and clinical teams. Patient harm can result from interpersonal interactions and communication breakdowns in this setting (Leonard et al, 2004).

Medical imaging technologist play a key role in diagnosis and are well-Dutiesed to offer expert commentary on radiographs globally. The Medical imaging technologist is by nature the first medical professional to assess each condition obtained by focusing on the patient. Radiologists are in a special Duties to connect. Their knowledgeable assessments of the process are communicated to the doctor promptly, and as a result, have a significant impact on patient care (Nick, 2014).

The job of the radiologist involves similar or identical responsibilities of documentation and certification to those of other medical specialist domains, even though diagnostic radiology appears to be distinguished by several unique operating aspects. The radiological medical procedure is a specialized medical service with diagnostic and/or interventional goals and is composed of several intricately interrelated parts, such as clinical-anamnestic evaluation,

including a review of any prior examinations; and justification for the proposed examination. The technical execution of the examination and picture generation; interpretation, reporting, and communication; information for consent and patient consent; a motivated lack of rationale (or potential recommendations for other modalities and procedures) (Tamburrini, & Dalla, 2007).

Modern healthcare is not complete without medical imaging because it offers non-invasive insights into the intricate structures and processes of the human body. The utilization of technology including X-rays, MRI, CT, ultrasound, and positron emission tomography (PET) has changed diagnosis, treatment planning, and disease monitoring.

Fine-grained cross-sectional images of the body are created using a sophisticated medical imaging technique called computed tomography (CT). By combining X-rays and powerful computer processing, CT scans offer a thorough, three-dimensional view of interior structures (Kalender, 2011).

A rotating X-ray equipment takes many X-ray images of the body during a CT scan from various angles. Using these photographs as input, the body's anatomy is then carefully cut into cross-sectional sections. The stacking of these slices into a 3D image allows medical professionals to see organs, tissues, bones, and abnormalities (McCollough, & Chen, 2008).

Magnetic Resonance Imaging (MRI), a non-invasive medical imaging technique, creates exact images of the inside organs and tissues of the body using powerful magnetic fields and radiofrequency pulses. Due to the lack of ionizing radiation, MRI is a safer option for patients (Haacke, et al 2019).

When the body is subjected to a strong magnetic field during an MRI scan, the hydrogen nuclei in the body's tissues align with the magnetic field. The alignment is then momentarily disturbed using radiofrequency pulses. The MRI scanner detects the radiofrequency signals that the hydrogen nuclei generate when they realign. These signals are used to provide finely detailed images of the body's soft tissues, organs, and structures (Rumack, & Charboneau, 2017).

Ultrasound imaging, often known as sonography, is a non-invasive medical imaging technique that uses high-frequency sound waves to provide real-time images of the internal organs of the body. These images allow medical professionals to more clearly see organs, tissues, blood flow, and other physiological processes (Rumack, & Charboneau, 2017).

During an ultrasonic scan, a portable device known as a transducer emits sound waves into the body. When these waves reverberate off different tissues and structures, echoes are produced. The transducer detects these echoes and sends them to a computer where they are processed to create images that are displayed on a screen (Barnett, & Kossoff, 2011).

Medical imaging technologies are used by radiology-trained medical practitioners to diagnose and treat illnesses and injuries. Radiologists are also in charge of performing image-guided, minimally invasive surgery or radiation therapy to address conditions including cancer and heart disease.

Medical imaging enables clinicians to more precisely assess patients' bones, organs, tissue, and blood arteries using non-invasive techniques. The techniques assist Radiologists during other procedures involving the implantation of devices inside the body, such as stents or catheters, help them locate tumors for treatment and removal, find blood clots or other blockages, and help them decide whether surgery would be an effective course of action.

In general, medical imaging has enhanced diagnosis and treatments by significantly reducing the amount of guesswork required by doctors, enabling them to more successfully treat patients' illnesses and injuries.

Medical imaging accounts for around 50% of all ionizing radiation exposure in the US (Laal, 2013).

The majority of critical medical anomalies and illnesses in the current era, including trauma disease, various cancer diseases, cardiovascular diseases, neurological disorders, and some other ailments, can now only be diagnosed by imaging techniques. Medical imaging techniques are used by highly qualified personnel, including internists and oncologists (Kaur, Goyal, 2014).

The information on the illness or condition required for therapy is provided by the medical diagnosis, which is determined from the patient's medical history, physical examinations, or surveys. The various signs and symptoms of an illness may be difficult to recognize because they lack specificity. Skin redness, or erythema, is one of many disease symptoms. Therefore, a range of diagnostic techniques are required to identify the underlying causes of some diseases and to treat or prevent them (McPhee, et al, 2010).

Protocol assignment for authorized advanced medical imaging (computed tomography, magnetic resonance, and nuclear medicine) orders is an essential yet undervalued operation in the workflow of an imaging department. Variations in performance in this function affect patient safety, department productivity and efficiency, care quality, and patient satisfaction.

Radiologists review physician prescriptions for difficult medical imaging procedures and offer comprehensive session-by-session treatment instructions. These medical decisions are routinely made with inadequate information and documentation. Exam requisitions, whether filed online or on paper, frequently lack adequate and/or accurate information, which is necessary to increase the quality and safety of radiologist protocol decisions (Li, et al, 2022).

Information such as allergy, laboratory, medication, prior clinical information, and other information that complements clinical detail not requested by an exam is typically available but rarely simple to acquire. To find and access the relevant data, numerous user interactions across various systems are often needed. It takes time to speak with ordering suppliers, for example, to clarify orders. Allocating advanced medical imaging protocol assignments is typically a "uncompensated" activity that is not subject to performance evaluation, which may encourage a radiologist to choose "efficiency" over effectiveness.

As for the Palestinian, there are several protocols used for medical imaging, whether in hospitals, private centres, or Non-governmental organizations (NGO)s.

1.2 Problem Statement

1. There are no unified protocols for medical imaging services in Palestine

2. There are no unified referral requests for medical imaging services in Palestine

1.3 Significance of Research

The purpose of this study to evaluate medical imaging services in Palestine as well as medical imaging protocols across all industries due to the country's absence of a uniform standard.

1.4 Objective of Research

1. To evaluate the utilization of medical imaging services in PHS, their protocols, and their level of availability.

2. To propose standardized criteria for medical imaging procedures, referral requests.

1.5 Research Hypothesis

1. Due to gender, age, job title, place of employment, years of experience, and credentials, there are no statistically significant changes in the percentages of respondents' attitudes toward the Duties of medical imaging technologist in medical imaging services at the level of 0.05..

2. The percentages of respondents' attitudes regarding the extent to which one protocol can be devised for all industries with workplaces show no statistically significant differences at the significance level of 0.05. (proofread and rephrase)

3. The percentages of respondents' thoughts toward the effects of medical imaging services and current protocols do not statistically differ with the workplace at the level of 0.05. (proofread and rephrase)

Chapter Two:

Study theory and Literature review:

2.1 Introduction

This chapter talks about medical imaging protocols and referral requests that must be explained. It also includes previous studies. Through these studies, it became clear that some studies emphasized the development of some protocols in different countries around the world.

2.2 Study theory

2.2.1 Medical imaging protocols

Medical imaging service protocols are referred to as a set of clear publications and definitions that must be adhered to by the employees of this service, whether these protocols are for the service recipient or the service provider. For example, is written consent always obtained from the client before the examination/procedure and for interventional procedures? Which uses contrast media? Is there a protocol for administering contrast media and precisely timing its arrival time for various examinations? Is the service recipient given the opportunity to express any complaint he/she may have toward the service staff and have their complaints recorded by the authorized person? Is all auxiliary equipment and machines used in the MRI examination area? Approved for use in the MRI environment. Is there documented technical testing of radiographic procedures from the point of registration to discharge? Is it made available in a clinically appropriate manner to staff, the client and others. Does the supervising radiologist have a comprehensive understanding of CT technology and tools as well as radiation safety? Is the highest priority given to safety? The client while dealing with, transporting, and staying with the client and implementing procedures and whether uniform implementation of protocols is ensured and any deviations are monitored

2.2.2 Referral requests

It is referred to as referral requests, but it is the request that is submitted to the Medical imaging technologist by the specialist doctor to perform the required medical image for the patient. Therefore, the submitted request must contain the appropriate information to prove the medical necessity of the examination and allow it to be performed and interpreted correctly, and this request must be made by the radiology technician as required. From the referring doctor. The submitted request must contain the following information:

1. A completed request for a specific procedure to be performed on the service recipient to assist in diagnosis, treatment planning, and treatment.

2. Relevant clinical information and history (including provisional diagnosis and history of allergy/contrast reactions).

3. Details of any previous imaging performed on the same patient.

4. Explanation for female service recipients of childbearing age regarding pregnancy with a history of LMP.

5. Fee transactions

2.2.3 Duties of Medical imaging technologist

The Duties of Medical imaging technologist is referred to as: What are the duties of , Medical imaging technologist whether these duties are for the recipient of the service or for Medical imaging technologist, whether these duties are related to radiation doses, safety checks, communication between the service provider and the service recipient, or verifying the quality of the images and explaining how to conduct the examination to the recipient? Service and how to deal with special cases (unconscious, sedated, or unconscious)

2.3 Literature review

Chenxin Li , Xin Lin and other in 2021 conducted a study to aiming to learn a model from different source domains and generalize it directly to unknown test domains. Modern meta-learning (MAML), which transfers knowledge from previous training tasks to enhance learning of new test tasks, was introduced to combat directorialism. the public. However, in clinical practice, only a small number of frequently annotated source domains are available, which reduces the ability to generate training problems and increases the potential for overfitting to training tasks in the model. A new DG strategy is introduced for cross-training with augmenting tasks on medical image classification. In this work. An incidental training paradigm based on meta-learning was created to establish information transfer from the simulated incidental training task to the actual DG test task. Overfitting at the level of the given task has been explored and task overfitting has been suggested to enhance diversity during training task construction to mitigate it. This is due to the scarcity of source domains in real-world medical publishing. In addition, we use a unique meta-goal to organize the deep embedding of practice areas using an established learning framework. Studies were conducted using CT scans of the abdomen and histopathological images to verify the effectiveness of the proposed technique (Penadés, et al, 2021).

Jonathan R. Medverd,corresponding and author Nathan M. Cross and other condcted study in 2013 aim Radiologists typically make decisions with minimal information at their disposal on protocol directions for the execution of advanced medical imaging tests. There is a chance to concurrently improve the safety, quality, and efficiency of this process by using an electronic solution that utilizes the assets of the health system to give quick, specialized information and decision support in real-time. This type of system has been developed for use within the Veterans Health Administration using open source software and open standards. The Radiology Protocol Tool Recorder (RAPTOR) project identified crucial process elements as well as inherent constraints of paper processes and electronic emulators of paper processes to aid in the construction of an ideal electronic replacement. The design offers a foundation that may be expanded upon to create an integrated radiology environment. In addition to having implications for the greater healthcare community, RAPTOR is a case study for modernizing outdated government health information systems (Medverd, et al, 2013).

Kenneth C Wang 1, Marc Kohli and other in 2014 cnducted study Technology standards serve as the cornerstone of the clinical process in radiology. This article discusses the International Classification of Diseases, Current Procedural Terminology, RadLex, and DICOM standards for coding and terminology, as well as the Health Level 7 standard for interacting with the healthcare enterprise. This third group has an effect on reporting and radiology practice administration. Knowing all of these requirements can aid radiologists in streamlining workflow and creating long-term planning (Wang, & Kohli, 2014).

Randhir Chellam, Ariel Botwin, and others conducted a study in 2017 that aimed to create a real-time electronic dashboard for a pediatric radiology reading room that would provide a visual representation of the latest details regarding upcoming and ongoing radiology examinations and help radiologists work more efficiently and effectively. This was accomplished by developing a script to automatically provide real-time HL7 messages to the Iguana Interface Engine of the Radiology Information System (Epic Systems, Verona, WI), while storing the necessary data about the exams in a SQL Server database for visual display on the dashboard. The adoption of an electronic dashboard in the reading room of academic pediatric radiology practice has enhanced clinical workflow, including reducing the time required for radiologist entry protocol for CT or MRI. Additional benefits include radiologists' enhanced ability to anticipate and manage tests that require monitoring or scanning as well as their ability to work with technologists and operations managers to optimize radiology resource scheduling. We have prevented the use of electronic dashboard technology in the future to improve the effectiveness of radiology workflow and the level of patient care (Shailam, et al, 2018).

Ana Penadés-Blasco , Sonia Ginés-Cárdenas and other in 2021 conducted a study to pursue In order to effectively manage the imaging process within clinical trials and improve the patient's quality of care, it is necessary to create and explain a management and control tool and the human resources required. To effectively organize our Medical Imaging Department's participation in clinical studies, a unit was established. Using a bespoke, adaptable, and modular software package that provides the essential data to execute and monitor requests (appointments, protocols, reports, complaints, and billing), this entity was developed and monitored. Numerous activity and job satisfaction variables were parameterized, and 50% of all hospital clinical trials

between 2016 and 2020 involved 367 trials in which participants were tracked. During this time, the Medical Imaging Department's budget increased by 47%. The collaboration Survey results revealed better communication with other departments and principle investigators (62% fluid and 38% very fluid), with a high perception of teamwork (86%) (Klotz, et al, 2015).

Ernst Klotz 1, Ulrike Haberland and other in 2015 conducted a study aimed at determining the technological requirements for current and advanced CT imaging in cancer treatment at safe dose levels. The main focus is on imaging of abdominal and thoracic tumors because these types of tumors present the greatest difficulties in terms of attenuation and patient movements. We will demonstrate that, regardless of other protocol selection decisions made, low-kV dynamic scanning in conjunction with detection technology designed for low photon fluxes has the greatest impact on dose reduction as we address the factors that determine appropriate temporal sampling, total scan duration, and why they are injection methods. An enhanced contrast medium is necessary for dose determination. These factors are derived from relatively basic first principles. The possibilities of standardized morphological extraction were simultaneously considered and a potential facilitator of the more widespread use of dynamic contrast CT in oncology is functional information from a single 4D scan (Lebre, et al, 2020).

Rui Lebre , Luís Bastião Silva and other in 2020 conducted a study to provides a multi-repository environment with access control techniques that are novel and integrate well with established protocols. As an extension of a well-known open-source archive, a secure accounting mechanism for medical imaging archives was created and put into operation. To offer a vendor-neutral solution consistent with contemporary DICOM Web protocols for storing, searching, and retrieving medical imaging data, a new web service layer was put in place. Through the incorporation of the suggested architecture into an open-source solution, the notion was validated. A quantitative analysis was done to determine how the mechanism will affect standard DICOM Web operations. The safe accounting architecture suggested in this article makes it simple to transform a basic medical imaging archive server into a multi-repository system (Tang, et al, 2023).

Shih-Tsang Tang , Victoria Tjia and other in 2023 conducted a study to the use of FHIR and DICOM servers with built-in standard RESTful APIs to organize medical pictures in a web-based workflow. The client systems in our integrated workflow leverage conventional FHIR and

DICOMweb APIs, including order placer, scheduler, imaging modality, viewer, and report generator. The suggested system also makes it easier to create reports in a uniform FHIR resource format. In this study, the image graphic annotations are recorded using W3C Scalable Vector Graphics (SVG), and the SVG image annotation is included in the FHIR observation. Reports, discoveries, and annotations are contained in FHIR DiagnosticReports and Observations, making it easier to apply and integrate the scheme into already-existing structures. The suggested plan may also make it possible to translate the outcomes of medical computer-aided detection/diagnosis into FHIR Diagnostic Reports and Observations, which are then saved on an FHIR server, from medical images. The resulting web-based solution records and exchanges imaging workflow-related information using FHIR XML and/or JSON data. Additionally, using the DICOM WADO-RS protocol, it can be used to record imaging reports, findings, and annotations related to the images. As a result, it is possible to combine all data produced during the workflow of medical imaging. Finally, it is simple to combine the suggested system with various FHIR systems (De Filippo, et al, 2011).

M De Filippo , A Corsi, L Evaristi and other in 2011 conducted a study In order to find recurring problems in both domains, this study assessed the appropriateness and correctness of 500 radiology requests and the corresponding reports.where 167 computed tomography (CT), 166 ultrasonography (US), and 167 radiography examinations were randomly selected as the sample, and they were gathered and analyzed in accordance with national referral criteria and the principles of justification and optimization (Law no. 187/2000).what is Inappropriate inquiries were prevalent (27.6%), as were ones without a clinical question (22%). Both the phrasing of the diagnostic question (76.8%) and the anamnestic data (80.6%) exhibited high levels of precision. The majority of requests were made by hand, and 12.5% did not include the recommending doctor's stamp and/or signature. The clinical information obtained or the tools employed were not stated in the study. Using There was usually a reported contrast medium. 9.8% of these papers included conclusions. In 60% of cases, the radiologist failed to report the need for more inquiry (Schneider, et al, 2011).

Shrooq Al-Dahery , Allison McGee and Louise Rainford in 2019 conducted a study to The objective of this study was to qualitatively compare the knowledge of current MRI radiographers from Saudi Arabia and the Republic of Ireland regarding MR image quality for abdominal and

pelvic MRI exams. Semistructured interviews were created to look into the professional responsibilities of radiographers regarding managing image quality, personal growth in MRI, and training in relation to image quality improvement. In addition to a variety of public and private Irish facilities, public, private, military, and academic hospitals in the Western region of the Kingdom of Saudi Arabia also took part. The interviews were conducted with clinical specialist radiologists (CSRs), supervisors, and MR radiologists who work in MR. These were transcribed, coded, and documented in the places Radiographers and CSRs/supervisors working in MRI departments in Saudi Arabia and Ireland had different perspectives and approaches to clinical care. To assist radiographers in the everyday maintenance of MR image quality, there is a need for additional training and subsequent professional skill assessments, including creating postgraduate possibilities, particularly for Saudi radiographers (Al-Dahery, et al, 2019).

B Chaka 1, H Adamson and other in 2022 conducted a study to The purpose of this study was to investigate how radiographers regarded their own professional abilities before, during, and after successfully completing postgraduate education. Radiographers enrolled in the CT and MRI courses willingly responded to questionnaires at three different time points. Questions were included to the previous survey to assess how they felt the courses had affected their clinical and professional practice. Results were analyzed using descriptive statistics, Wilcoxon matched pairs signed rank, and Friedman tests to identify the various time points where postgraduate education benefits radiographers and their clinical departments. The courses gave radiographers, particularly those with experience in CT and/or MRI, the chance to gain skills that they could apply in the clinical setting and help with service delivery (Kada, 2020).

Sundaran Kada in 2020 conducted a study to The current study evaluates student radiographers' comprehension of CT exposure parameters, where A twenty-one-item survey that was given to final-year student radiographers was used to gauge their awareness of CT exposure parameters. The survey consisted of questions about the parameters of CT exposure, and respondents could either select "true" or "false" as their answer, or they may select from a range of options where only one choice was appropriate. One mark was awarded for each correct response, but none was awarded for each incorrect response. Seventy-two students completed and returned the questionnaire, yielding a 71% response rate. The score out of 21 was translated to a percentage, with a larger percentage indicating greater knowledge. The average result was 53%. just 33%

of pupils answered properly determined that milliampere seconds (mAs) should be increased when body part thickness grows and kilovoltage peak (kVp) should be increased when patients have metallic implants. Nobody was able to accurately respond to every query. There was no discernible difference in understanding between students who had access to CT facilities on campus and those who did not. Overall, it was determined that student radiographers' understanding of CT exposure settings was good (Kada, 2020).

Benjamin M Ellingson , Martin Bendszus and other in 2015 conducted a study to aim The US Food and Drug Administration (FDA), National Cancer Institute (NCI), clinical scientists, imaging specialists, pharmaceutical and biotech companies, clinical trials cooperative groups, and patient advocacy groups recently met to discuss imaging endpoints for clinical trials in glioblastoma. The implementation of a standardized MRI procedure for multicenter studies was one of the action items that came out of this workshop's development of priorities. The consensus recommendations for a standardized Brain Tumor Imaging Protocol (BTIP) are presented in the current document, along with the rationale for each recommendation's use in clinical trials and its scientific and practical underpinnings. These recommendations were reached after a series of discussions among various experts involved in different facets of neuro-oncology neuroimaging. (i) Parameter-matched precontrast and postcontrast inversion recovery are the minimum required sequences.isotropic 3D T1-weighted, prepared gradient-recalled echo; (ii) precontrast, axial 2D T2-weighted fluid-attenuated inversion recovery; (iii) axial 2D T2-weighted turbo spin-echo acquired after contrast injection and prior to postcontrast 3D T1-weighted images to control timing of images after contrast administration; and (iv) precontrast, axial 2D 3-directional diffusion-weighted images. Both 1.5 T and 3 T MR systems are given recommended sequence parameter ranges (Ellingson, et la, 2015).

W Elshami , M M Abuzaid and other in 2022 conducted a study to aim analyzes the perspectives, beliefs, and expectations of radiographers for their role growth in the UAE. To extract the perceptions of radiographers, a qualitative research study design utilizing Focus Group Discussions (FGD) was used. Radiographers employed by hospitals and clinics under the Ministry of Health and Prevention's supervision participated in the study. Participants were questioned about jobs that have been identified as advancement roles, clinical role requirements, obstacles, and steps that must be taken to get radiographers ready for responsibilities that are

extended or established. An independent research assistant captured the conversations on audio and afterwards transcribed them. Data analysis employed thematic analysis. Where Out of the 29 radiographers that took part in the FGDs, 83% (or 24 people) expressed interest in career advancement. According to FGD, their practice at the moment exhibits some informal extended roles that may encourage professional advancement. Participants' knowledge level as offered by the current curriculum and the need for support from the education and licensing bodies to adapt change were the two biggest issues they noted. The study found a need for education and licensing authority support to enable radiographers to develop in their careers by increasing their knowledge and experience (Elshami, et al, 2022).

M M Abuzaid , W Elsham and other in 2022 conducted a study to aim to ascertain the level of radiologists' support for implementing reporting radiographers' advanced practice Dutiess in the UAE by looking into their perspectives, perceptions, and willingness to undertake these duties. where A mixed-methods study design that comprised a survey and focus group discussions (FGD) was used to gather the data. Radiologists who are currently employed by governmental and commercial health institutions in the UAE were study participants. Direct emails containing the survey URL, a covering letter, and a participant information sheet detailing the study's objectives were sent to the radiologists. On the survey, participants stated that they would be interested in taking part in a focus group discussion (FGD) on the topic of whether or not radiographers' concerns about their involvement in image interpretation might be allayed if they took part in education and training for their new roles. Additionally, this could increase the trust in radiologists' confidence and ability and training of radiographers (Abuzaid, et al, 2022).

A-R Wuni , N Courtier and other in 2020 conducted a study to aim To examine factors that affect the implementation of role extension in radiography and to talk about how it might benefit healthcare in Ghana, where there is a dearth of research on the subject. Role expansion in radiography has been impacted by a number of causes, including a lack of radiologists, a growth in the demand for radiology services, government regulation, and the desire of radiographic technologists for professional advancement. where are Radiographers may report radiographs as accurately as radiologists, according to the evidence, and receiving the right education enhances their performance. The professional practice most likely to assist local patients is radiographer-led reporting. To develop confidence in radiography-led reporting, changes in

professional perspectives, training, education, and regulation of reporting are necessary (Wuni, et al, 2020).

Robin Decoster , Rachel Toomey and other in 2023 conducted a study to aim examines if factors affecting image quality could serve as indicators to explain the differences between the types of jobs that Three data sets (chest PA, hip HBL, and c-spine lateral), each containing 25 radiographs, were evaluated by a total of 74 radiologists and radiographers from three different countries. All reviewers assigned a grade to the image quality based on the ACR RadLex classification, location, collimation, detector exposure, and anatomical visualisation. On a clinically appropriate display, all evaluations were conducted. To evaluate image quality assessments between groups, visual grading criteria were utilized. Radiographers are more skeptical of the diagnostic utility than radiologists are of the visualization of anatomical structures. The assessment of anatomical structures does not account for the variance in the studied criteria. A radiograph is a greater likelihood of being disqualified if the observer (subjectively) believed that the detector exposure was incorrect. For radiologists, this link is more significant (Decoster, et al, 2023).

E Kjelle ,A K Schanche and other in 2020 conducted a study to aim to determine the discrepancies in how radiologists and radiographers see the quality of plain radiographs, a poll of these professionals was conducted. Radiographers (n = 116) and radiologists (n = 76) in a hospital trust in Norway were given an online survey that included 30 clinical cases (one image and a brief referral text) that were sorted into three groups based on European guidelines: keep, could keep, and reject. Dutiesing, collimation, centering, artifact, or exposure error were the top reasons given for rejection by the respondents, who checked the appropriate box on a list. The 2-tailed chi-squared test was used to examine group differences. For a multi-rater sample, inter-subjectivity was assessed using Cohen's kappa, where On the evaluation of high-quality photos, radiologists and radiographers appear to agree, while radiographers appear more hesitant to accept inferior photos than those produced by radiologists (Al Mohammad, & Alakhras, 2023).

Badera Al Mohammad , Maram M Alakhras and other in 2023 conducted a study to aim to evaluate CT radiographers' current understanding of the optimization of CT settings and their implications on patient dose and image quality in situations From January 2nd to March 1st, 2023, researchers across Jordan conducted a cross-sectional study to assess CT radiographers'

expertise in controlling CT parameters. Radiographers were invited to engage in the convenience sampling throughout the recruitment process and complete the survey. The normalized knowledge scores were reported using descriptive statistics. The results of several subgroups were examined and compared using the Student's t-test and ANOVA. Several factors connected to technology were investigated for their impact on the knowledge score using a forward stepwise linear regression. The findings show that radiologists have an overall solid comprehension of CT parameters, with academic training having a big impact on how they perform (Al Mohammad, & Alakhras, 2023).

Carmen Khan , Günter Ollenschläger in 2014 conducted a study to aim In the present research, the findings of a thorough literature review that evaluated German QM/QA programs in the inpatient sector are described. The electronic databases Medline, Cochrane Library, and websites of institutions with a focus on the topic were used to conduct a comprehensive literature search. Additionally, manual searches and the Google Scholar search engine were employed. There was no time restriction on the literature search for Germany. Studies measuring the effects on outcomes, process, or structure of inpatient treatment were only chosen if they included a comparison group without or at the start of a QM/QA programme. The eligible studies' methodological quality was evaluated and summarized where There were no credible scientific studies that demonstrated the usefulness or ineffectiveness of the established quality programs with regard to patients for the German healthcare system. Despite the lack of appropriate data and the difficulties in conducting persuasive assessment studies in the field of QM/QA, known evaluation research methods should be used and expanded (Khan, et al, 2014).

M M Willemse , M Williams and other in 2020 conducted a study to aim the management of QA programs in digital diagnostic imaging departments (DDIDs) in public hospitals of a big metropolitan region, and to investigate and report the experiences of diagnostic radiographs and radiography managers who are in charge of those programs. Data for this study were gathered using semi-structured interviews in a South African (RSA) context using a qualitative, explorative, descriptive, and contextual research approach. The target population consisted of 16 radiography managers and radiographers employed by public hospitals, and data collection persisted until saturation (n = 10) was reached. Participants discussed the value of management oversight in QA initiatives, placing particular attention on staffing, training, scheduling, and

funding. Budgeting issues have been linked to difficulties with equipment upkeep. Participants felt the necessity to eliminate delays in the execution of the QC tests when the QA officer was not present, for all workers to be taught and involved in the QA program (Willemse, et al, 2019)

W Alsharif , A McGee and other in 2018 conducted a study to aim to investigate the views and attitudes of MR specialists in the Kingdom of Saudi Arabia (KSA) regarding the state of regular QA testing inside MRI departments, In this interview-based study, MR specialists from public, semi-public, and private hospitals in the KSA were invited to participate using a qualitative approach. A total of 52 individual semi-structured interviews with MR radiographers and medical physicists based at 19 major centers in the three main geographical regions of the KSA were conducted using a purposeful sampling technique. Data were coded in accordance with a qualitative data analysis approach based on the philosophical foundations of Miles and Huberman. what is The findings of this study urge the creation of a national policy and legal necessity to encourage Radiographers in the KSA should participate actively in MRI quality assurance testing to enable the early detection of subpar MR scanner performance (Alsharif, et al, 2018).

Martha Sitareni , Abel Karera and other in 2023 conducted a study to aim to investigate radiographers' perspectives on how radiologists at two public hospitals in Namibia justify radiographic operations. This study used an exploratory, qualitative methodology. Using a semi-structured interview guide and an audio recorder, 13 specifically chosen radiographers from radiology departments at two tertiary public hospitals in Namibia were interrogated. Face-to-face interviews were used for every interview until data saturation was reached. Utilizing Tesch's 8-step qualitative data analysis process, data were analyzed using Atlas.ti Windows (version 9.0) to produce themes and subthemes where The study found a correlation between both positive and bad experiences and the justification of radiological techniques. A beneficial experience in terms of the radiographers' duties was improved patient-centered treatment. The retired communication assistance device was a The restricted availability and use of communication methods that are intended to strengthen and promote justification by radiographers was a poor experience for me. The paper suggests doing a thorough investigation to identify and quantify unnecessary hospital departments 1 and 2. To build awareness and a foundation for shared decision-making models, continuous professional development that concentrates on

justification and referral processes must be carried out in collaboration between radiologists and referrers (Sitareni, et al, 2023).

Yiftach Barash , Eyal Klang and other in 2023 conducted a study to aim was to assess ChatGPT-4's performance as a decision support tool for deciding which imaging tests to order and producing radiology referrals in the emergency department (ED), where is For each of the following pathologies—pulmonary embolism, obstructive kidney stones, acute appendicitis, diverticulitis, small intestinal obstruction, acute cholecystitis, acute hip fracture, and testicular torsion—five consecutive clinical notes from the ED were retrospectively collected. There were 40 cases altogether. These notes were entered into ChatGPT-4 and asked for advice on the best imaging procedures and protocols. Additionally, the chatbot was instructed to produce radiological recommendations. The referral was rated on a scale of 1 to 5 by two separate radiologists for its clarity, clinical relevance, and differential diagnosis. The ACR Appropriateness Criteria (AC) and with the chatbot's imaging recommendations the ED's physical examinations. A linear weighted average was used to measure reader agreement. where is Cohen's coefficient ChatGPT-4 has the ability to assist in choosing imaging studies for certain clinical scenarios. Large language models could be used in conjunction with radiography to enhance referral quality. Radiologists need to stay up to date on this technology and be aware of any hazards and difficulties that could arise (Barash, et al, 2023)

Chapter Three:

3.1 Methodology:

The researcher prepared a questionnaire of 35 items to achieve of the objectives of this study, which is emphasizing no standardization in medical imaging protocol and the referral requests in the Palestinian health system. The items of the questionnaire distributed into 3 domains: Protocols of medical imaging services, Duties of medical imaging technologist and Referral

Requests Protocols. After collecting the distributed questionnaires, the researcher prepared the data for the analysis, the answers of the respondents on the items of the questionnaires were recoded to numeric values, the value 1 given for the answer (Yes), the value 2 given for the answer (No), and the value 3 given for the answer (Don't know).

The Quantitative (Descriptive and Analytic) Methodology used in this research, the statistical package for social sciences software (SPSS) Version 23 was used for the data analysis in this study. The researcher conducted descriptive statistics (Frequencies, Percentages) for all the items of the questionnaire, and the Chi-Square test was used to test the study hypotheses, this test is usually used to test the differences in percentages assuming that the P-Value ≤ 0.05 is considered significant.

3.2 The time of data collection

From 1/8 to 1/10 in 2023, retrospective data will be gathered from all hospitals and medical imaging facilities in Palestine.

3.3 Inclusion Criteria

In this research, there is no specific age, all radiologists and medical imaging technologist will be included.

3.4 Study population and Sample:

The population of this study includes all the radiologists and medical imaging technologist working in the Palestinian health. A study sample of 15 radiologists and 190 medical imaging technologist and 30 Radiology resident Physician working in the Palestinian health sector were selected randomly, most of them are Males (72.3%), while the percentage of females are (27.7%). Most of the respondents in the study sample are Medical imaging Technicians (80.9%), and only 6.4% are Consultant Radiologists and 12.8% are Radiology resident Physicians. The distribution of the respondents in the study sample according to the work place is : 34% work in Public Health Centers or Hospitals, 27.7% work in NGO Health Centers or Hospitals, and 38.3% work in Private Health Centers or Hospitals. The following table (3.1) show numbers and percentages of the personal information and characteristics of the study sample:

Table (3.1): Frequencies and Percentages of the personal information and characteristics of the study sample (N=235).

Variable	Category	N (%)
Age	22-30	76(32.3%)
	31-40	91(38.7%)
	41 years or more	68(28.9%)
	Total	235(100%)
Gender	Male	170(72.3%)
	Female	65(27.7%)
	Total	235(100%)
Experience	<= 5 years	43(18.3%)
	6-10	75(31.9%)
	11-20	77(32.8%)
	21 years or more	40(17%)
	Total	235(100%)
Workplace	Public Health Center or Hospital	80(34%)
	NGO Health Center or Hospital	65(27.7%)
	Private Health Center or Hospital	90(38.3%)
	Total	235(100%)
Specialty	Consultant Radiologist	15(6.4%)
	Radiology resident Physician	30(12.8%)
	Medical imaging Technician	190(80.9%)
	Total	235(100%)

And the following table (3.2) show numbers and percentages of the Medical Imaging Modalities available in the medical imaging division:

Table (3.2): Frequencies and Percentages of the Medical Imaging Modalities available in the medical imaging division (N=235).

Category	N (%)
X-Ray Radiography	221(94%)
Fluoroscopy	14(6%)
Dental Imaging	25(10.6%)
CT scan	208(88.5%)
CBCT	13(5.5%)
MRI	183(77.9%)
U/S	184(78.3%)
Y-Camera (Anger camera)	1(0.4%)
SPECT	3(1.3%)
PET	2(0.9%)

The results in the table above show that the highest Medical Imaging Modality available in the medical imaging divisions is the X-Ray Radiography (94%), the second one is the CT scan (88.5%), the third one is the U/S (78.3%), and the fourth one is the MRI (77.9%).

3.6 Reliability:

The technique of measuring variables must be reliable as this reflects the extent to which the questionnaire is stable and consistent. This means that a measure is reliable if it gives the same result each time the scale or the factor is measured. Cronbach's' alpha coefficient was used to estimate the internal consistency of the main domains of the questionnaire used for this study. The following table (3.3) show the results of Cronbach's' alpha coefficients for the main study domains using the full sample of 235 questionnaires:

Table (3.3): Cronbach's' alpha coefficients for the main study domains (N=235).

Domain	Number of Items	Cronbachs' alpha
Protocols of medical imaging services	18	0.86
Duties of medical imaging technologist	8	0.84
Referral Requests Protocols	12	0.81

The results in the table (3.3) above show that the values of Cronbachs' alpha coefficients are : 86% for Protocols of medical imaging services, 84% for the Duties of radiology technician, and 81% for the Referral Requests Protocols, and all these values are acceptable because all of them are greater than 70%, indicating very good internal consistency and Reliability for the scales measured in this study.

3.7 Validity

The validity of the research tool (questionnaire) means how many the items of this questionnaire are related and measure the wanted scale. In this research, the validity examines the extent to which the items of the questionnaire are related and measure their related domains (Protocols of medical imaging services, Duties of radiology technician, Referral Requests Protocols). To check the validity, the questionnaire was evaluated by some experts in the field of the medical imaging procedures, and interest in the related issues.

From the other hand, the researcher conducted the construct validity by Factor Analysis based on the principle component method. This method measures how much the items are related to their domains by computing the Extraction Communalities (E.C.) for each item. As these values are higher than or equal 0.5, a high explained amount of the variance of each individual item is obtained, and so a high extent of validity. The following are the results of Factor Analysis using the full sample of 235 respondents:

Table (3.4): Frequencies and Percentages of the respondent's answers toward the items of the Protocols of medical imaging services according to Specialty (N=235).

Item		Specialty																	
		Consultant Radiologist						Radiology resident Physician						Medical imaging Technician					
		Yes		No		Don't Know		Yes		No		Don't Know		Yes		No		Don't Know	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Is there a local or international working protocol for various medical imaging examinations in your department?	q1	6	40.0 %	3	20.0 %	6	40.0 %	15	50.0 %	12	40.0 %	3	10.0 %	43	22.6 %	131	68.9 %	16	8.4%
If the answer to the previous question is yes: Is the protocol local?	q2	7	46.7 %	3	20.0 %	5	33.3 %	15	50.0 %	12	40.0 %	3	10.0 %	45	23.7 %	110	57.9 %	35	18.4 %
If the answer to the first question is yes, is the protocol uniform in all the health sector in which you work?	q3	7	46.7 %	6	40.0 %	2	13.3 %	11	36.7 %	13	43.3 %	6	20.0 %	42	22.1 %	117	61.6 %	31	16.3 %
Are the roles and responsibilities of each unit providing medical imaging services defined?	q4	9	60.0 %	5	33.3 %	1	6.7%	12	40.0 %	17	56.7 %	1	3.3%	49	25.8 %	97	51.1 %	44	23.2 %
Is there a clear job description for the various employees in the medical imaging department in the institution?	q5	9	60.0 %	6	40.0 %	0	.0%	16	53.3 %	8	26.7 %	6	20.0 %	41	21.6 %	119	62.6 %	30	15.8 %
Is the time required to manage, display/deploy, implement and monitor medical imaging procedures from referral to exit from the medical imaging device?	q6	9	60.0 %	6	40.0 %	0	.0%	12	40.0 %	14	46.7 %	4	13.3 %	45	23.7 %	117	61.6 %	28	14.7 %

Do the protocols address medical imaging/radiology in the general population and provide for specific modifications in the case of children or adults with special requirements?	q7	9	60.0 %	2	13.3 %	4	26.7 %	13	43.3 %	12	40.0 %	5	16.7 %	37	19.5 %	127	66.8 %	26	13.7 %
Are there clear definitions or job descriptions of the roles and responsibilities of staff to manage each area of image acquisition, image quality and therapeutic procedures according to their training and experience?	q11	5	33.3 %	10	66.7 %	0	.0%	6	20.0 %	22	73.3 %	2	6.7%	22	11.6 %	137	72.1 %	31	16.3 %
Are diagnostic and therapeutic protocols for all procedures developed, communicated, implemented and monitored	q12	7	46.7 %	8	53.3 %	0	.0%	1	3.3%	23	76.7 %	6	20.0 %	25	13.2 %	147	77.4 %	18	9.5%
Is written consent always obtained from the service recipient prior to the examination/procedure for interventional procedures using Contrast Media (CM)	q20	11	73.3 %	3	20.0 %	1	6.7%	5	16.7 %	22	73.3 %	3	10.0 %	35	18.4 %	133	70.0 %	22	11.6 %
Is there a protocol for administering CM contrast media and precisely timing its arrival time for various examinations?	q21	11	73.3 %	2	13.3 %	2	13.3 %	11	36.7 %	17	56.7 %	2	6.7%	33	17.4 %	131	68.9 %	26	13.7 %

Is the service recipient given the opportunity to express any complaints he may have towards the service employees and have their complaints recorded by the authorized person?	q23	4	26.7 %	10	66.7 %	1	6.7%	8	26.7 %	17	56.7 %	5	16.7 %	39	20.5 %	127	66.8 %	24	12.6 %
Are all auxiliary equipment and machines used in the various inspection units approved for use in the environment of each unit?	q24	6	40.0 %	6	40.0 %	3	20.0 %	7	23.3 %	20	66.7 %	3	10.0 %	37	19.5 %	130	68.4 %	23	12.1 %
Is there documented technical testing of radiographic procedures from the point of registration to discharge and is it made available in a clinically appropriate manner to staff, service recipients and others?	q26	3	20.0 %	11	73.3 %	1	6.7%	8	26.7 %	21	70.0 %	1	3.3%	32	16.8 %	127	66.8 %	31	16.3 %
Is uniform implementation of protocols ensured and any deviations monitored?	q32	6	40.0 %	6	40.0 %	3	20.0 %	6	20.0 %	20	66.7 %	4	13.3 %	24	12.6 %	140	73.7 %	26	13.7 %
Does each medical imaging unit have one or more supervising radiologists generally responsible for the operation of the department?	q33	5	33.3 %	8	53.3 %	2	13.3 %	9	30.0 %	18	60.0 %	3	10.0 %	44	23.2 %	123	64.7 %	23	12.1 %
Does the Medical Imaging Department have a Radiation Prevention and Safety Officer (RSO)?	q34	2	13.3 %	10	66.7 %	3	20.0 %	6	20.0 %	22	73.3 %	2	6.7%	31	16.3 %	139	73.2 %	20	10.5 %

Is there a full-time administrator for the PACS archiving and communication system in the organization?	q35	1	6.7%	13	86.7 %	1	6.7%	10	33.3 %	17	56.7 %	3	10.0 %	47	24.7 %	122	64.2 %	21	11.1 %

Table (3.5): Frequencies and Percentages of the respondent's answers toward the items of the Duties of radiology technician according to Specialty (N=235).

Item		Specialty																	
		Consultant Radiologist						Radiology resident Physician						Medical imaging Technician					
		Yes		No		Don't Know		Yes		No		Don't Know		Yes		No		Don't Know	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Are radiation doses as low as can be reasonably achieved for all subjects (ALARA principle), especially for children, women of reproductive age, pregnant women, and workers with frequent exposure?	q13	6	40.0%	6	40.0%	3	20.0%	12	40.0%	15	50.0%	3	10.0%	48	25.3%	106	55.8%	36	18.9%
Is the minimum exposure to different types of electromagnetic fields, radio frequencies and any noise specified?	q17	5	33.3%	7	46.7%	3	20.0%	7	23.3%	21	70.0%	2	6.7%	46	24.2%	109	57.4%	35	18.4%
Are safety checks performed before entering various medical imaging procedures for all service seekers, employees and others to reduce the risks associated with the procedures?	q18	3	20.0%	9	60.0%	3	20.0%	6	20.0%	22	73.3%	2	6.7%	44	23.2%	116	61.1%	30	15.8%
Is there communication to and from the service recipient during the process of performing x-ray/radiography on the conscious service recipient? Verbal communication can be direct or through a system of microphones, speakers, receiving systems, or bell or light methods	q22	8	53.3%	6	40.0%	1	6.7%	8	26.7%	20	66.7%	2	6.7%	42	22.1%	113	59.5%	35	18.4%
Is how the examination is performed and how to use the relevant equipment explained to the service recipient before the procedure?	q28	7	46.7%	7	46.7%	1	6.7%	2	6.7%	26	86.7%	2	6.7%	28	14.7%	120	63.2%	42	22.1%

Is the unconscious, sedated, or sedated service recipient continuously monitored according to protocols by skilled personnel during the procedure for parameters such as pulse, breathing, oxygen saturation, and level of consciousness	q29	7	46.7%	4	26.7%	4	26.7%	9	30.0%	20	66.7%	1	3.3%	33	17.4%	123	64.7%	34	17.9%
Is the client's safety given the highest priority while handling, transporting, staying and carrying out procedures	q30	4	26.7%	10	66.7%	1	6.7%	5	16.7%	23	76.7%	2	6.7%	44	23.2%	121	63.7%	25	13.2%
Is the quality of the images verified by trained and registered radiology and imaging staff, in terms of their technical nature as well as the therapeutic and diagnostic content relevant to the service recipient’s condition?	q31	2	13.3%	10	66.7%	3	20.0%	4	13.3%	24	80.0%	2	6.7%	38	20.0%	120	63.2%	32	16.8%

Table (3.6): Frequencies and Percentages of the respondent's answers toward the items of the Referral Requests Protocols according to Specialty (N=235).

Item		Specialty																	
		Consultant Radiologist						Radiology resident Physician						Medical imaging Technician					
		Yes		No		Don't Know		Yes		No		Don't Know		Yes		No		Don't Know	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Are alternative radiographic modalities offered if they are considered based on radiation risks or newer clinical practices emerging in collaboration with the referrer?	q8	3	20.0%	10	66.7%	2	13.3%	6	20.0%	23	76.7%	1	3.3%	30	15.8%	118	62.1%	42	22.1%
Is medical and treatment information related to previous clinical, laboratory and radiological details relevant to providing complete and comprehensive information about the patient's condition (service recipient) included in the referral report?	q9	4	26.7%	10	66.7%	1	6.7%	8	26.7%	22	73.3%	0	.0%	29	15.3%	121	63.7%	40	21.1%
Is patient feedback and comments obtained, categorized, analyzed and used as a guide for future improvement in the service delivery system in place in your workplace?	q10	3	20.0%	10	66.7%	2	13.3%	6	20.0%	22	73.3%	2	6.7%	27	14.2%	118	62.1%	45	23.7%
Is there a written request (referral) from the referring physician or other appropriately licensed health care provider, who must provide appropriate information to substantiate the medical necessity of the test and allow it to be properly performed and interpreted?	q14	5	33.3%	9	60.0%	1	6.7%	8	26.7%	21	70.0%	1	3.3%	30	15.8%	116	61.1%	44	23.2%

A completed request for a specific, clear procedure to be performed on the service recipient to assist in diagnosis, treatment planning, and treatment.	q15_1	4	26.7%	8	53.3%	3	20.0%	6	20.0%	24	80.0%	0	.0%	36	18.9%	107	56.3%	47	24.7%
Relevant clinical information and history (including provisional diagnosis and history of allergy/contrast reactions).	q15_2	3	20.0%	11	73.3%	1	6.7%	6	20.0%	19	63.3%	5	16.7%	21	11.1%	131	68.9%	38	20.0%
Details of any previous imaging performed on the same patient.	q15_3	2	13.3%	12	80.0%	1	6.7%	7	23.3%	18	60.0%	5	16.7%	26	13.7%	121	63.7%	43	22.6%
Explanation for female service recipients of childbearing age regarding pregnancy with a history of LMP.	q15_4	4	26.7%	10	66.7%	1	6.7%	9	30.0%	19	63.3%	2	6.7%	16	8.4%	128	67.4%	46	24.2%
If the treating physician does not specify the procedure, is the examination postponed and the referrer is asked to provide the information	q16	4	26.7%	7	46.7%	4	26.7%	7	23.3%	23	76.7%	0	.0%	26	13.7%	122	64.2%	42	22.1%
Is there a documented procedure for urgent and unexpected emergency patients?	q19	5	33.3%	7	46.7%	3	20.0%	2	6.7%	25	83.3%	3	10.0%	25	13.2%	130	68.4%	35	18.4%
Whether the choice of procedure to be performed is what the referring physician orders	q25	7	46.7%	6	40.0%	2	13.3%	9	30.0%	17	56.7%	4	13.3%	33	17.4%	113	59.5%	44	23.2%
Is charging information documented, displayed, and provided to the service recipient/caregiver upon request, prior to the examination	q27	4	26.7%	8	53.3%	3	20.0%	3	10.0%	23	76.7%	4	13.3%	18	9.5%	129	67.9%	43	22.6%

Chapter Four:

Result and Discussion:

4.1Result:

The Analysis of the Study Hypotheses:

1) Protocols of Medical Imaging Services.

The following table shows the frequencies and percentages of the respondent's answers toward the items of the protocols of medical imaging services:

Table (4.1): Frequencies and Percentages of the respondent's answers toward the items of the Protocols of medical imaging services (N=235).

No	Item	Protocols of medical imaging services		
		Yes	No	Don't know
q1	Is there a local or international working protocol for various medical imaging examinations in your department?	64(27.2%)	146(62.1%)	25(10.6%)
q2	If the answer to the previous question is yes: Is the protocol local?	67(28.5%)	125(53.2%)	43(18.3%)
q3	If the answer to the first question is yes, is the protocol uniform in all the health sector in which you work?	60(25.5%)	136(57.9%)	39(16.6%)
q4	Are the roles and responsibilities of each unit providing medical imaging services defined?	70(29.8%)	119(50.6%)	46(19.6%)
q5	Is there a clear job description for the various employees in the medical imaging department in the institution?	66(28.1%)	133(56.6%)	36(15.3%)
q6	Is the time required to manage, display/deploy, implement and monitor medical imaging procedures from referral to exit from the medical imaging device?	66(28.1%)	137(58.3%)	32(13.6%)
q7	Do the protocols address medical imaging/radiology in the general population and provide for specific modifications in the case of children or adults with special requirements?	59(25.1%)	141(60%)	35(14.9%)
q11	Are there clear definitions or job descriptions of the roles and responsibilities of staff to manage	33(14%)	169(71.9%)	33(14%)

No	Item	Protocols of medical imaging services		
		Yes	No	Don't know
	each area of image acquisition, image quality and therapeutic procedures according to their training and experience?			
q12	Are diagnostic and therapeutic protocols for all procedures developed, communicated, implemented and monitored	33(14%)	178(75.7%)	24(10.2%)
q20	Is written consent always obtained from the service recipient prior to the examination/procedure for interventional procedures using Contrast Media (CM)	51(21.7%)	158(67.2%)	26(11.1%)
q21	Is there a protocol for administering CM contrast media and precisely timing its arrival time for various examinations?	55(23.4%)	150(63.8%)	30(12.8%)
q23	Is the service recipient given the opportunity to express any complaints he may have towards the service employees and have their complaints recorded by the authorized person?	51(21.7%)	154(65.5%)	30(12.8%)
q24	Are all auxiliary equipment and machines used in the various inspection units approved for use in the environment of each unit?	50(21.3%)	156(66.4%)	29(12.3%)
q26	Is there documented technical testing of radiographic procedures from the point of registration to discharge and is it made available in a clinically appropriate manner to staff, service recipients and others?	43(18.3%)	159(67.7%)	33(14%)
q32	Is uniform implementation of protocols ensured and any deviations monitored?	36(15.3%)	166(70.6%)	33(14%)
q33	Does each medical imaging unit have one or more supervising radiologists generally responsible for the operation of the department?	58(24.7%)	149(63.4%)	28(11.9%)
q34	Does the Medical Imaging Department have a Radiation Prevention and Safety Officer (RSO)?	39(16.6%)	171(72.8%)	25(10.6%)
q35	Is there a full-time administrator for the PACS archiving and communication system in the organization?	58(24.7%)	152(64.7%)	25(10.6%)

The results in the table above show that generally there are no standards of the protocols of medical imaging services, because most of the respondent's attitudes toward the items are negative.

According to the highest negative items, the following results can be concluded: The diagnostic and therapeutic protocols for all procedures are not developed, communicated, implemented or

monitored (75.7%), the uniform implementation of protocols is not ensured and no deviations monitored (70.6%), there are no clear definitions or job descriptions of the roles and responsibilities of staff to manage each area of image acquisition, image quality and therapeutic procedures according to their training and experience (71.9%), the Medical Imaging Department don't have a Radiation Prevention and Safety Officer (RSO) (72.8%).

2) Duties of medical imaging technologist.

The following table shows the frequencies and percentages of the respondent's answers toward the items of the Duties of radiology technician:

Table (4.2): Frequencies and Percentages of the respondent's answers toward the items of the Duties of radiology technician (N=235).

No	Item	Duties of radiology technician		
		Yes	No	Don't know
q13	Are radiation doses as low as can be reasonably achieved for all subjects (ALARA principle), especially for children, women of reproductive age, pregnant women, and workers with frequent exposure?	66(28.1%)	127(54%)	42(17.9%)
q17	Is the minimum exposure to different types of electromagnetic fields, radio frequencies and any noise specified?	58(24.7%)	137(58.3%)	40(17%)
q18	Are safety checks performed before entering various medical imaging procedures for all service seekers, employees and others to reduce the risks associated with the procedures?	53(22.6%)	147(62.6%)	35(14.9%)
q22	Is there communication to and from the service recipient during the process of performing x-ray/radiography on the conscious service recipient? Verbal communication can be direct or through a system of microphones, speakers, receiving systems, or bell or light methods	58(24.7%)	139(59.1%)	38(16.2%)
q28	Is how the examination is performed and how to use the relevant equipment explained to the service recipient before the procedure?	37(15.7%)	153(65.1%)	45(19.1%)
q29	Is the unconscious, sedated, or sedated service recipient continuously monitored according to protocols by skilled personnel during the	49(20.9%)	147(62.6%)	39(16.6%)

No	Item	Duties of radiology technician		
		Yes	No	Don’t know
	procedure for parameters such as pulse, breathing, oxygen saturation, and level of consciousness			
q30	Is the client's safety given the highest priority while handling, transporting, staying and carrying out procedures	53(22.6%)	154(65.5%)	28(11.9%)
q31	Is the quality of the images verified by trained and registered radiology and imaging staff, in terms of their technical nature as well as the therapeutic and diagnostic content relevant to the service recipient’s condition?	44(18.7%)	154(65.5%)	37(15.7%)

The results in the table above show that generally there are no standards of the Duties of radiology technician, because most of the respondent’s attitudes toward the items are negative. According to the highest negative items, the following results can be concluded:

How the examination is not performed and how to use the relevant equipment is not explained to the service recipient before the procedure (65.1%), the client's safety is not given the highest priority while handling, transporting, staying and carrying out procedures (65.5%), the quality of the images in not verified by trained and registered radiology and imaging staff, in terms of their technical nature as well as the therapeutic and diagnostic content relevant to the service recipient’s condition (65.5%), safety checks are not performed before entering various medical imaging procedures for all service seekers, employees and others to reduce the risks associated with the procedures (62.6%), the unconscious, sedated, or sedated service recipient is not continuously monitored according to protocols by skilled personnel during the procedure for parameters such as pulse, breathing, oxygen saturation, and level of consciousness (62.6%).

3) Referral Requests Protocols.

The following table shows the frequencies and percentages of the respondent's answers toward the items of the Referral Requests Protocols:

Table (4.3): Frequencies and Percentages of the respondent's answers toward the items of the Referral Requests Protocols (N=235).

No	Item	Referral Requests Protocols		
		Yes	No	Don't know
q8	Are alternative radiographic modalities offered if they are considered based on radiation risks or newer clinical practices emerging in collaboration with the referrer?	39(16.6%)	151(64.3%)	45(19.1%)
q9	Is medical and treatment information related to previous clinical, laboratory and radiological details relevant to providing complete and comprehensive information about the patient's condition (service recipient) included in the referral report?	41(17.4%)	153(65.1%)	41(17.4%)
q10	Is patient feedback and comments obtained, categorized, analyzed and used as a guide for future improvement in the service delivery system in place in your workplace?	36(15.3%)	150(63.8%)	49(20.9%)
q14	Is there a written request (referral) from the referring physician or other appropriately licensed health care provider, who must provide appropriate information to substantiate the medical necessity of the test and allow it to be properly performed and interpreted?	43(18.3%)	146(62.1%)	46(19.6%)
Does the referral request by the referring physician include the following information:				
q15_1	A completed request for a specific, clear procedure to be performed on the service recipient to assist in diagnosis, treatment planning, and treatment.	46(19.6%)	139(59.1%)	50(21.3%)
q15_2	Relevant clinical information and history (including provisional diagnosis and history of allergy/contrast reactions).	30(12.8%)	161(68.5%)	44(18.7%)
q15_3	Details of any previous imaging performed on the same patient.	35(14.9%)	151(64.3%)	49(20.9%)
q15_4	Explanation for female service recipients of childbearing age regarding pregnancy with a history of LMP.	29(12.3%)	157(66.8%)	49(20.9%)

No	Item	Referral Requests Protocols		
		Yes	No	Don't know
q16	If the treating physician does not specify the procedure, is the examination postponed and the referrer is asked to provide the information	37(15.7%)	152(64.7%)	46(19.6%)
q19	Is there a documented procedure for urgent and unexpected emergency patients?	32(13.6%)	162(68.9%)	41(17.4%)
q25	Whether the choice of procedure to be performed is what the referring physician orders	49(20.9%)	136(57.9%)	50(21.3%)
q27	Is charging information documented, displayed, and provided to the service recipient/caregiver upon request, prior to the examination	25(10.6%)	160(68.1%)	50(21.3%)

The results in the table above show that generally there are no standards of the Referral Requests Protocols, because most of the respondent's attitudes toward the items are negative.

According to the highest negative items, the following results can be concluded: the referral request by the referring physician doesn't include the relevant clinical information and history (including provisional diagnosis and history of allergy/contrast reactions) (68.5%), there is no a documented procedure for urgent and unexpected emergency patients (68.9%), charging information is not documented, displayed, or provided to the service recipient/caregiver upon request, prior to the examination (68.1%), the referral request by the referring physician doesn't include explanation for female service recipients of childbearing age regarding pregnancy with a history of LMP (66.8%), the medical and treatment information is not related to previous clinical, laboratory and radiological details relevant to providing complete and comprehensive information about the patient's condition (service recipient) included in the referral report (65.1%).

The Analysis of the Study Hypotheses:

Main Hypothesis: There are no statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services, the Duties of radiology technician, and the referral requests in the Palestinian health system.

The researcher computed the frequencies and percentages, and the results of Chi-square test of equality of percentages used to test the differences of the respondent's attitudes toward the protocol for medical imaging services, the Duties of radiology technician, and the referral requests, and the following table shows the related results:

Table (4.4): The results of Frequencies, Percentages, and the Chi-square test of equality of percentages to test the main hypothesis (N=235).

Domain	Answers			Chi-square	P-value
	Yes	No	Don't know		
Protocols of Medical Imaging Services	56(23.8%)	157(66.8%)	22(9.4%)	125.881	0.000
Duties of medical imaging technologist	53(22.6%)	144(61.3%)	38(16.2%)	84.009	0.000
Referral Requests Protocols	34(14.5%)	160(68.1%)	41(17.4%)	128.026	0.000

The results in the table above show that there are significant differences at 0.05 level between the total percentages of the respondent's answers in the study sample toward the related items of the study domains (Protocols of Medical Imaging Services, Duties of radiology technician, Referral Requests Protocols). This result implies that there is no standardization in medical imaging protocol and the referral requests in the Palestinian health system.

The results show that the percentage of the negative attitudes (No answers) toward the Protocols of Medical Imaging Services is (p=66.8%) which is significantly higher than the other percentages regarding the Protocols of Medical Imaging Services (23.8%, 9.4%), also the percentage of the negative attitudes (No answers) toward the Duties of radiology technician

(p=61.3%) which is significantly higher than the other percentages regarding the Duties of radiology technician (22.6%, 16.2%), and also the percentage of the negative attitudes (No answers) toward the Referral Requests Protocols (p=68.1%) is significantly higher than the other percentages regarding the Referral Requests Protocols (14.5%, 17.4%). The P-values of the tests are less than 0.05, so the results imply to accept the **main hypothesis: There are no statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services, the Duties of radiology technician, and the referral requests in the Palestinian health system.**

The Analysis of the Sub-hypotheses:

First Hypothesis: There are no statistically significant differences in the attitudes of radiologists and medical imaging technologist towards the protocol for medical imaging services due to the workplace and specialty.

The researcher computed the frequencies and percentages, and the results of Chi-square test of equality of percentages used to test the differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services due to the workplace and the specialty, and the following table shows the related results:

Table (4.5): The results of Frequencies, Percentages, and the Chi-square test of the differences in the attitudes toward the protocol for medical imaging services due to the workplace and the specialty (N=235).

Variable	Category	Protocols of Medical Imaging Services				Chi-square	P-value
		Yes	No	Don't Know	Total		
Workplace	Public Health Center or Hospital	10(12.5%)	64(80%)	6(7.5%)	80(100%)	11.259	0.024
	NGO Health Center or Hospital	22(33.8%)	37(56.9%)	6(9.2%)	65(100%)		
	Private Health Center or Hospital	24(26.7%)	56(62.2%)	10(11.1%)	90(100%)		
	Total	56(23.8%)	157(66.8%)	22(9.4%)	235(100%)		

Variable	Category	Protocols of Medical Imaging Services				Chi-square	P-value
		Yes	No	Don't Know	Total		
Specialty	Consultant Radiologist	9(60%)	3(20%)	3(20%)	15(100%)	22.640	<0.001
	Radiology resident Physician	12(40%)	16(53.3%)	2(6.7%)	30(100%)		
	Medical imaging Technician	35(18.4%)	138(72.6%)	17(8.9%)	190(100%)		
	Total	56(23.8%)	157(66.8%)	22(9.4%)	235(100%)		

The results in the table above show that there are statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services due to the workplace and specialty at 0.05 level.

The results show that the percentage of the negative attitudes (No answers) toward the protocol for medical imaging services is (p=80%) in the Public Health Centers or Hospitals which is significantly higher than those in both the NGO Health Centers or Hospitals and in the Private Health Centers or Hospitals (56.9%, 62.2%). Also the results show that the percentage of the negative attitudes toward the protocol for medical imaging services is the highest percentage in each work place, the P-value of the tests is 0.024<0.05.

The results also show that the percentage of the positive attitudes (Yes answers) toward the protocol for medical imaging services for the Consultant Radiologists is (p=60%) is significantly higher than that for both the Radiology resident Physicians and for the Medical imaging Technicians (40%, 18.4%). From the other hand, the results show that the percentage of the negative attitudes (No answers) toward the protocol for medical imaging services for both the Radiology resident Physicians and for the Medical imaging Technicians (53.3%, 72.6%) are significantly higher than that for the Consultant Radiologists (p=20%), the P-value of the tests is less than 0.001.

These results imply to reject the **First Hypothesis: There are no statistically significant differences in the attitudes of radiologists and medical imaging technologist towards the protocol for medical imaging services due to the workplace and specialty.**

Second Hypothesis: There are no statistically significant differences in the attitudes of radiology specialists and radiology technicians towards the Duties of medical imaging technologist due to Age, Gender, Experience, Workplace, and Specialty.

The researcher computed the frequencies and percentages, and the results of Chi-square test of equality of percentages used to test the differences in the attitudes of radiology specialists and radiology technicians towards the Duties of radiology technician due to Age, Gender, Experience, Workplace, and Specialty, and the following table shows the related results:

Table (4.6): The results of Frequencies, Percentages, and the Chi-square test of the differences in the attitudes toward the Duties of radiology technician due to Age, Gender, Experience, Workplace, and Specialty (N=235).

Variable	Category	Duties of radiology technician				Chi-square	P-value
		Yes	No	Don't Know	Total		
Age	22-30	20(26.3%)	43(56.6%)	13(17.1%)	76(100%)	11.753	0.019
	31-40	25(27.5%)	58(63.7%)	8(8.8%)	91(100%)		
	41 years or more	8(11.8%)	43(63.2%)	17(25%)	68(100%)		
	Total	53(22.6%)	144(61.3%)	38(16.2%)	235(100%)		
Gender	Male	37(21.8%)	102(60%)	31(18.2%)	170(100%)	1.954	0.376
	Female	16(24.6%)	42(64.6%)	7(10.8%)	65(100%)		
	Total	53(22.6%)	144(61.3%)	38(16.2%)	235(100%)		
Experience	<= 5 years	14(32.6%)	22(51.2%)	7(16.3%)	43(100%)	4.298	0.038
	6-10	18(24%)	45(60%)	12(16%)	75(100%)		
	11-20	18(23.4%)	50(64.9%)	9(11.7%)	77(100%)		
	21 years or more	3(7.5%)	27(67.5%)	10(25%)	40(100%)		
	Total	53(22.6%)	144(61.3%)	38(16.2%)	235(100%)		
Workplace	Public Health Center or Hospital	8(10%)	58(72.5%)	14(17.5%)	80(100%)	11.104	0.025
	NGO Health Center or Hospital	19(29.2%)	36(55.4%)	10(15.4%)	65(100%)		

Variable	Category	Duties of radiology technician				Chi-square	P-value
		Yes	No	Don't Know	Total		
	Private Health Center or Hospital	26(28.9%)	50(55.6%)	14(15.6%)	90(100%)		
	Total	53(22.6%)	144(61.3%)	38(16.2%)	235(100%)		
Specialty	Consultant Radiologist	5(33.3%)	9(60%)	1(6.7%)	15(100%)	11.015	0.026
	Radiology resident Physician	4(13.3%)	25(83.3%)	1(3.3%)	30(100%)		
	Medical imaging Technician	44(23.2%)	110(57.9%)	36(18.9%)	190(100%)		
	Total	53(22.6%)	144(61.3%)	38(16.2%)	235(100%)		

The results in the table above show that there are statistically significant differences at 0.05 level in the attitudes of radiology specialists and radiology technicians towards the Duties of radiology technician only due to Age, Experience, Workplace, and Specialty, while no significant differences appeared due to gender.

Regarding the age variable, the results show that the percentages of the positive attitudes toward the Duties of radiology technician for the age groups (22-30) and (31-40) are respectively (26.3, 27.5%), and these percentages are significantly higher than the age group (41 years or more) (p=11.8%), the P-value of the test is 0.019<0.05.

Regarding the experience variable, the results show that the percentages of the positive attitudes toward the Duties of medical imaging technologist for the groups (<= 5 years, 6-10, and 11-20) are respectively (32.6%, 24%, 23.4%), and these percentages are significantly higher than the group (21 years or more) (p=7.5%), and the percentage of negative attitudes toward the Duties of radiology technician for the (21 years or more) (p=67.5%) is significantly higher than the other groups, the P-value of the test is 0.038<0.05.

Regarding the workplace, the results show that the percentage of the negative attitudes is (p=72.5%) in the Public Health Centers or Hospitals which is significantly higher than those for

the NGO Health Centers or Hospitals and for the Private Health Centers or Hospitals (55.4%, 55.6%), also the results show that the percentage of the negative attitudes is the highest percentage regarding the Duties of radiology technician among each work place, the P-value of the test is 0.025<0.05.

Regarding the Specialty, the results show that the percentage of the negative attitudes for the Radiology resident Physicians (p=83.3%) is higher than the percentages for the Consultant Radiologists and for the Medical imaging Technician (60%, 57.9%), the P-value of the test is 0.026<0.05.

These results imply to reject the **Second Hypothesis: There are no statistically significant differences in the attitudes of radiology specialists and radiology technicians towards the Duties of medical imaging technologist due to Age, Experience, Workplace, and Specialty,** and accept the hypothesis due to Gender.

Third Hypothesis: There are no statistically significant differences in the attitudes of radiologists and medical imaging technologist towards protocols related to referral requests due to the workplace and specialty.

The researcher computed the frequencies and percentages, and the results of Chi-square test of equality of percentages used to test the differences in the attitudes of radiologists and radiology technicians towards the protocols related to the referral requests due to the workplace and the specialty, and the following table shows the related results:

Table (4.7): The results of Frequencies, Percentages, and the Chi-square test of the differences in the attitudes toward the protocols related to referral requests due to the workplace and the specialty (N=235).

Variable	Category	Protocols related to Referral Requests				Chi-square	P-value
		Yes	No	Don't Know	Total		
Workplace	Public Health Center or Hospital	4(5%)	64(80%)	12(15%)	80(100%)	10.719	0.030
	NGO Health Center or Hospital	13(20%)	41(63.1%)	11(16.9%)	65(100%)		

Variable	Category	Protocols related to Referral Requests				Chi-square	P-value
		Yes	No	Don't Know	Total		
	Private Health Center or Hospital	17(18.9%)	55(61.1%)	18(20%)	90(100%)		
	Total	34(14.5%)	160(68.1%)	41(17.4%)	235(100%)		
Specialty	Consultant Radiologist	3(20%)	10(66.7%)	2(13.3%)	15(100%)	13.173	0.010
	Radiology resident Physician	5(16.7%)	25(83.3%)	0(0%)	30(100%)		
	Medical imaging Technician	26(13.7%)	125(65.8%)	39(20.5%)	190(100%)		
	Total	34(14.5%)	160(68.1%)	41(17.4%)	235(100%)		

The results in the table above show that there are statistically significant differences in the attitudes of radiologists and medical imaging technologist towards the protocols related to referral requests due to the workplace and specialty at 0.05 level.

The results show that the percentage of the negative attitudes (No answers) toward the protocols related to referral requests is (p=80%) in the Public Health Centers or Hospitals which is significantly higher than those in both the NGO Health Centers or Hospitals and in the Private Health Centers or Hospitals (63.1%, 61.1%). Also the results show that the percentage of the negative attitudes toward the protocols related to referral requests is the highest percentage in each work place, the P-value of the tests is $0.030<0.05$.

The results also show that the percentage of the negative attitudes (No answers) toward the protocols related to referral requests for the Radiology resident Physicians (p=83.3%) is significantly higher than that for both the Consultant Radiologists and for the Medical imaging Technicians (66.7%, 65.8%), the P-value of the tests is $0.010<0.05$.

These results imply to reject the **Third Hypothesis: There are no statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocols related to referral requests due to the workplace and specialty.**

4.2 Discussion

The results showed that generally there are no standards of the protocols of medical imaging services. According to the highest negative items, some results can be concluded: The diagnostic and therapeutic protocols for all procedures are not developed, communicated, implemented or monitored, the uniform implementation of protocols is not ensured and no deviations monitored, there are no clear definitions or job descriptions of the roles and responsibilities of staff to manage each area of image acquisition, image quality and therapeutic procedures according to their training and experience, the Medical Imaging Department don't have a Radiation Prevention and Safety Officer (RSO).

The results showed that generally there are no standards of the Duties medical imaging technologist. According to the highest negative items, some results can be concluded: How the examination is not performed and how to use the relevant equipment is not explained to the service recipient before the procedure, the client's safety is not given the highest priority while handling, transporting, staying and carrying out procedures, the quality of the x ray images in not verified by trained and registered radiology and imaging staff, in terms of their technical nature as well as the therapeutic and diagnostic content relevant to the service recipient's condition, safety checks are not performed before entering various medical imaging procedures for all service seekers.

The results showed that generally there are no standards of the Referral Requests Protocols. According to the highest negative items, some results can be concluded: the referral request by the referring physician doesn't include the relevant clinical information and history (including provisional diagnosis and history of allergy/contrast reactions), there is no a documented procedure for urgent and unexpected emergency patients, charging information is not documented, displayed, or provided to the service recipient/caregiver upon request, prior to the examination, the referral request by the referring physician doesn't include explanation for female service recipients of childbearing age regarding pregnancy with a history of LMP, the medical and treatment information is not related to previous clinical, laboratory and radiological details relevant to providing complete and comprehensive information about the patient's condition (service recipient) included in the referral report.

The results showed that there are significant differences at 0.05 level between the total percentages of the respondent's answers in the study sample toward the related items of the study domains (Protocols of Medical Imaging Services, Duties of radiology technician, Referral Requests Protocols).

The results showed that the percentage of the negative attitudes (No answers) toward the Protocols of Medical Imaging Services is significantly higher than the other percentages regarding the Protocols of Medical Imaging Services, also the percentage of the negative attitudes (No answers) toward the Duties of radiology technician is significantly higher than the other percentages regarding the Duties of radiology technician, and also the percentage of the negative attitudes (No answers) toward the Referral Requests Protocols is significantly higher than the other percentages regarding the Referral Requests Protocols, so the results implied to accept the **main hypothesis:**

There are statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services, the Duties of radiology technician, and the referral requests in the Palestinian health system.

The results showed that there are statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services due to the workplace and specialty at 0.05 level.

The results showed that the percentage of the negative attitudes (No answers) toward the protocol for medical imaging services in the Public Health Centers or Hospitals which is significantly higher than those in both the NGO Health Centers or Hospitals and in the Private Health Centers or Hospitals, also The results showed that the percentage of the negative attitudes toward the protocol for medical imaging services is the highest percentage in each work place.

The results also showed that the percentage of the positive attitudes (Yes answers) toward the protocol for medical imaging services for the Consultant Radiologists is significantly higher than that for both the Radiology resident Physicians and for the Medical imaging Technicians. From the other hand, the results showed that the percentage of the negative attitudes (No answers) toward the protocol for medical imaging services for both the Radiology resident Physicians and for the Medical imaging Technicians are significantly higher than that for the Consultant Radiologists.

These results implied to reject the **First Hypothesis: There are no statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocol for medical imaging services due to the workplace and specialty.**

The results showed that there are statistically significant differences at 0.05 level in the attitudes of radiology specialists and radiology technicians towards the Duties of radiology technician only due to Age, Experience, Workplace, and Specialty, while no significant differences appeared due to gender.

Regarding the age variable, the results showed that the percentages of the positive attitudes toward the Duties of radiology technician for the age groups (22-30) and (31-40) are significantly higher than the age group (41 years or more).

Regarding the experience variable, the results showed that the percentages of the positive attitudes toward the Duties of radiology technician for the groups (<= 5 years, 6-10, and 11-20) are significantly higher than the group (21 years or more), and the percentage of negative attitudes toward the Duties of radiology technician for the (21 years or more) is significantly higher than the other groups.

Regarding the workplace, the results showed that the percentage of the negative attitudes in the Public Health Centers or Hospitals is significantly higher than those for the NGO Health Centers or Hospitals and for the Private Health Centers or Hospitals, also the results showed that the percentage of the negative attitudes is the highest percentage regarding the Duties of radiology technician among each work place.

Regarding the Specialty, the results showed that the percentage of the negative attitudes for the Radiology resident Physicians is higher than the percentages for the Consultant Radiologists and for the Medical imaging Technician.

These results implied to reject the **Second Hypothesis: There are no statistically significant differences in the attitudes of radiology specialists and radiology technicians towards the Duties of radiology technician due to Age, Experience, Workplace, and Specialty,** and accept the hypothesis due to Gender.

The results showed that there are statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocols related to referral requests due to the workplace and specialty at 0.05 level.

The results showed that the percentage of the negative attitudes (No answers) toward the protocols related to referral requests in the Public Health Centers or Hospitals is significantly higher than those in both the NGO Health Centers or Hospitals and in the Private Health Centers or Hospitals, also the results showed that the percentage of the negative attitudes toward the protocols related to referral requests is the highest percentage in each work place.

The results also show that the percentage of the negative attitudes (No answers) toward the protocols related to referral requests for the Radiology resident Physicians is significantly higher than that for both the Consultant Radiologists and for the Medical imaging Technicians.

These results implied to reject the **Third Hypothesis: There are no statistically significant differences in the attitudes of radiologists and radiology technicians towards the protocols related to referral requests due to the workplace and specialty.**

for Consultant Radiologist, they negatively answered toward the item (Is there a local or international working protocol for various medical imaging examinations in your department?) with percentage 20%, and for Radiology resident Physician with percentage 40%, and for Medical imaging Technician with percentage 69%. For Consultant Radiologist, they negatively answered toward the item (If the answer to the previous question is yes: Is the protocol local?) with percentage 20%, and for Radiology resident Physician with percentage 40%, and for Medical imaging Technician with percentage 58%. For Consultant Radiologist, they negatively answered toward the item (If the answer to the first question is yes, is the protocol uniform in all the health sector in which you work?) with percentage 40%, and for Radiology resident Physician with percentage 43%, and for Medical imaging Technician with percentage 62%. For Consultant Radiologist, they negatively answered toward the item (Are the roles and responsibilities of each unit providing medical imaging services defined?) with percentage 33%, and for Radiology resident Physician with percentage 57%, and for Medical imaging Technician with percentage 51%. For Consultant Radiologist, they negatively answered toward the item (Is there a clear job description for the various employees in the medical imaging department in the

institution?) with percentage 40%, and for Radiology resident Physician with percentage 27%, and for Medical imaging Technician with percentage 63%. For Consultant Radiologist, they negatively answered toward the item (Is the time required to manage, display/deploy, implement and monitor medical imaging procedures from referral to exit from the medical imaging device?) with percentage 40%, and for Radiology resident Physician with percentage 47%, and for Medical imaging Technician with percentage 62%. For Consultant Radiologist, they negatively answered toward the item (Do the protocols address medical imaging/radiology in the general population and provide for specific modifications in the case of children or adults with special requirements?) with percentage 13%, and for Radiology resident Physician with percentage 40%, and for Medical imaging Technician with percentage 67%. For Consultant Radiologist, they negatively answered toward the item (Are there clear definitions or job descriptions of the roles and responsibilities of staff to manage each area of image acquisition, image quality and therapeutic procedures according to their training and experience?) with percentage 67%, and for Radiology resident Physician with percentage 73%, and for Medical imaging Technician with percentage 72%. For Consultant Radiologist, they negatively answered toward the item (Are diagnostic and therapeutic protocols for all procedures developed, communicated, implemented and monitored) with percentage 53%, and for Radiology resident Physician with percentage 77%, and for Medical imaging Technician with percentage 77%. For Consultant Radiologist, they negatively answered toward the item (Is written consent always obtained from the service recipient prior to the examination/procedure for interventional procedures using Contrast Media (CM)) with percentage 20%, and for Radiology resident Physician with percentage 73%, and for Medical imaging Technician with percentage 70%. For Consultant Radiologist, they negatively answered toward the item (Is there a protocol for administering CM contrast media and precisely timing its arrival time for various examinations?) with percentage 13%, and for Radiology resident Physician with percentage 57%, and for Medical imaging Technician with percentage 69%. For Consultant Radiologist, they negatively answered toward the item (Is the service recipient given the opportunity to express any complaints he may have towards the service employees and have their complaints recorded by the authorized person?) with percentage 67%, and for Radiology resident Physician with percentage 57%, and for Medical imaging Technician with percentage 67%. For Consultant Radiologist, they negatively answered toward the item (Are all auxiliary equipment and

machines used in the various inspection units approved for use in the environment of each unit?) with percentage 40%, and for Radiology resident Physician with percentage 67%, and for Medical imaging Technician with percentage 68%. For Consultant Radiologist, they negatively answered toward the item (Is there documented technical testing of radiographic procedures from the point of registration to discharge and is it made available in a clinically appropriate manner to staff, service recipients and others?) with percentage 73%, and for Radiology resident Physician with percentage 70%, and for Medical imaging Technician with percentage 67%. For Consultant Radiologist, they negatively answered toward the item (Is uniform implementation of protocols ensured and any deviations monitored?) with percentage 40%, and for Radiology resident Physician with percentage 67%, and for Medical imaging Technician with percentage 74%. For Consultant Radiologist, they negatively answered toward the item (Does each medical imaging unit have one or more supervising radiologists generally responsible for the operation of the department?) with percentage 53%, and for Radiology resident Physician with percentage 60%, and for Medical imaging Technician with percentage 65%. For Consultant Radiologist, they negatively answered toward the item (Does the Medical Imaging Department have a Radiation Prevention and Safety Officer (RSO)?) with percentage 67%, and for Radiology resident Physician with percentage 73%, and for Medical imaging Technician with percentage 73%. For Consultant Radiologist, they negatively answered toward the item (Is there a full-time administrator for the PACS archiving and communication system in the organization?) with percentage 87%, and for Radiology resident Physician with percentage 57%, and for Medical imaging Technician with percentage 64%.

for Consultant Radiologist, they negatively answered toward the item (Are radiation doses as low as can be reasonably achieved for all subjects (ALARA principle), especially for children, women of reproductive age, pregnant women, and workers with frequent exposure?) with percentage 40%, and for Radiology resident Physician with percentage 50%, and for Medical imaging Technician with percentage 56%. For Consultant Radiologist, they negatively answered toward the item (Is the minimum exposure to different types of electromagnetic fields, radio frequencies and any noise specified?) with percentage 47%, and for Radiology resident Physician with percentage 70%, and for Medical imaging Technician with percentage 57%. For Consultant Radiologist, they negatively answered toward the item (Are safety checks performed before entering various medical imaging procedures for all service seekers, employees and

others to reduce the risks associated with the procedures?) with percentage 60%, and for Radiology resident Physician with percentage 73%, and for Medical imaging Technician with percentage 61%. For Consultant Radiologist, they negatively answered toward the item (Is there communication to and from the service recipient during the process of performing x-ray/radiography on the conscious service recipient? Verbal communication can be direct or through a system of microphones, speakers, receiving systems, or bell or light methods) with percentage 40%, and for Radiology resident Physician with percentage 67%, and for Medical imaging Technician with percentage 60%. For Consultant Radiologist, they negatively answered toward the item (Is how the examination is performed and how to use the relevant equipment explained to the service recipient before the procedure?) with percentage 47%, and for Radiology resident Physician with percentage 87%, and for Medical imaging Technician with percentage 63%. For Consultant Radiologist, they negatively answered toward the item (Is the unconscious, sedated, or sedated service recipient continuously monitored according to protocols by skilled personnel during the procedure for parameters such as pulse, breathing, oxygen saturation, and level of consciousness) with percentage 27%, and for Radiology resident Physician with percentage 67%, and for Medical imaging Technician with percentage 65%. For Consultant Radiologist, they negatively answered toward the item (Is the client's safety given the highest priority while handling, transporting, staying and carrying out procedures) with percentage 67%, and for Radiology resident Physician with percentage 77%, and for Medical imaging Technician with percentage 64%. For Consultant Radiologist, they negatively answered toward the item (Is the quality of the images verified by trained and registered radiology and imaging staff, in terms of their technical nature as well as the therapeutic and diagnostic content relevant to the service recipient's condition?) with percentage 67%, and for Radiology resident Physician with percentage 80%, and for Medical imaging Technician with percentage 63%.

for Consultant Radiologist, they negatively answered toward the item (Are alternative radiographic modalities offered if they are considered based on radiation risks or newer clinical practices emerging in collaboration with the referrer?) with percentage 67%, and for Radiology resident Physician with percentage 77%, and for Medical imaging Technician with percentage 62%. For Consultant Radiologist, they negatively answered toward the item (Is medical and treatment information related to previous clinical, laboratory and radiological details relevant to

providing complete and comprehensive information about the patient's condition (service recipient) included in the referral report?) with percentage 67%, and for Radiology resident Physician with percentage 73%, and for Medical imaging Technician with percentage 64%. For Consultant Radiologist, they negatively answered toward the item (Is patient feedback and comments obtained, categorized, analyzed and used as a guide for future improvement in the service delivery system in place in your workplace?) with percentage 67%, and for Radiology resident Physician with percentage 73%, and for Medical imaging Technician with percentage 62%. For Consultant Radiologist, they negatively answered toward the item (Is there a written request (referral) from the referring physician or other appropriately licensed health care provider, who must provide appropriate information to substantiate the medical necessity of the test and allow it to be properly performed and interpreted?) with percentage 60%, and for Radiology resident Physician with percentage 70%, and for Medical imaging Technician with percentage 61%. For Consultant Radiologist, they negatively answered toward the item (A completed request for a specific, clear procedure to be performed on the service recipient to assist in diagnosis, treatment planning, and treatment.) with percentage 53%, and for Radiology resident Physician with percentage 80%, and for Medical imaging Technician with percentage 56%. For Consultant Radiologist, they negatively answered toward the item (Relevant clinical information and history (including provisional diagnosis and history of allergy/contrast reactions).) with percentage 73%, and for Radiology resident Physician with percentage 63%, and for Medical imaging Technician with percentage 69%. For Consultant Radiologist, they negatively answered toward the item (Details of any previous imaging performed on the same patient.) with percentage 80%, and for Radiology resident Physician with percentage 60%, and for Medical imaging Technician with percentage 64%. For Consultant Radiologist, they negatively answered toward the item (Explanation for female service recipients of childbearing age regarding pregnancy with a history of LMP.) with percentage 67%, and for Radiology resident Physician with percentage 63%, and for Medical imaging Technician with percentage 67%. For Consultant Radiologist, they negatively answered toward the item (If the treating physician does not specify the procedure, is the examination postponed and the referrer is asked to provide the information) with percentage 47%, and for Radiology resident Physician with percentage 77%, and for Medical imaging Technician with percentage 64%. For Consultant Radiologist, they negatively answered toward the item (Is there a documented procedure for

urgent and unexpected emergency patients?) with percentage 47%, and for Radiology resident Physician with percentage 83%, and for Medical imaging Technician with percentage 68%. For Consultant Radiologist, they negatively answered toward the item (Whether the choice of procedure to be performed is what the referring physician orders) with percentage 40%, and for Radiology resident Physician with percentage 57%, and for Medical imaging Technician with percentage 60%. For Consultant Radiologist, they negatively answered toward the item (Is charging information documented, displayed, and provided to the service recipient/caregiver upon request, prior to the examination) with percentage 53%, and for Radiology resident Physician with percentage 77%, and for Medical imaging Technician with percentage 68%.

Chapter Five:

Conclusion and Recommendations:

5.1 Conclusion

Medical imaging technologist review your doctor Transferred request for complex medical imaging tests and provide detailed procedure instructions for each session. These medical choices are often made based on little knowledge and poor documentation. In order to improve the quality and integrity of diagnostic protocol provisions, testing requests must not lack sufficient and/or accurate information, whether submitted online or on paper. It should also be noted that the Palestinian health system does not have standardized imaging protocols. Therefore, we recommend establishing a unified protocol for medical imaging services in all health sectors.

The idea was to evaluate the use of medical imaging services in public health services, their protocols, and their level of availability, as well as to propose unified standards for medical imaging procedures, referral requests.

The method of this study includes 235 samples. Radiologists and medical imaging technologist of both genders with different work experience were randomly recruited. To study their opinions on standardizing and developing medical imaging protocols, referral requests in the Palestinian health system.

The results showed that there are no unified protocols for medical imaging services in Palestine, and there are no unified referral requests in the Palestinian health system. The idea of creating a unified protocol for medical imaging services in all sectors of Palestinian health was supported.

5.2 Recommendations

Based on our studies, we recommend the following:

1. We recommend unifying medical imaging protocols in medical imaging departments in Palestine in all sectors

2. We recommend that referral requests contain sufficient information for the patient

5. We recommend that uniform implementation of protocols be ensured and any deviations monitored

6. We recommend that the choice of procedure to be performed be that which the referring physician orders

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نحو توحيد وتطوير بروتوكولات التصوير الطبي وطلبات الإحالة في النظام الصحي الفلسطيني

اعداد الطالب: ليث جرادات

اشراف : د. محمد حجوج

الملخص :

مقدمة : يلعب التصوير الطبي دوراً محورياً في الرعاية الصحية، وخاصة في مجال الأشعة التشخيصية حيث تستخدم إجراءات التصوير لتشخيص الأمراض ومراقبتها ومتابعتها. في هذه العملية، يلعب تقنيو التصوير الطبي (MIT) دورًا حاسمًا في تقييم حالات المرضى وتقييمها، وتتضمن إجراءات التصوير الطبي التشخيصي أو التداخلي عناصر مترابطة، حيث يوفر التقييم السريري وتبرير الفحص معلومات أساسية للعلاج، وتعيين تعد بروتوكولات التصوير الطبي المتقدم المعتمدCT) ، MRI، (NMمهمة حيوية ولكن غالبًا ما يتم تجاهلها في سير عمل أقسام التصوير الطبي. غالبًا ما يكون الحصول على تفاصيل سريرية إضافية، بما في ذلك معلومات الحساسية والمختبرات والأدوية، أمرًا معقدًا، ويتطلب تفاعلات متعددة عبر الأنظمة. في المستشفيات والمراكز الصحية التابعة للنظام الصحي الفلسطيني (العامة والخاصة والمنظمات غير الحكومية)، يتم استخدام بروتوكولات التصوير الطبي المختلفة.

الهدف من الدراسة: هو فحص وتقييم بروتوكولات خدمات التصوير الطبي المتقدمة داخل النظام الصحي الفلسطيني بسبب عدم وجود معيار ثابت في جميع أنحاء البلاد، واقتراح معايير قياسية أولية لإجراءات التصوير الطبي المتقدمة

الطريقة : من أجل تحقيق أهداف الدراسة والتي تسلط الضوء على غياب التقييس في بروتوكولات التصوير الطبي وطلبات الإحالة داخل النظام الصحي الفلسطيني، قام الباحث بتطوير استبانة تتكون من 35 فقرة، وقد تم تصنيف بنود الاستبيان إلى ثلاثة مجالات: بروتوكولات التصوير الطبي خدمات التصوير، منصب فني التصوير الطبي، وبروتوكولات طلبات الإحالة، المنهجية الوصفية والتحليلية الكمية المستخدمة في هذا البحث، بعد جمع الاستبيانات الموزعة، قام الباحث بمعالجة البيانات للتحليل، وتم إعادة ترميز إجابات المجيبين على عناصر الاستبيان إلى أرقام رقمية حيث كانت قيمة 1 لـ "نعم"، و2 لـ "لا"، و3 لـ "لا أعرف". والمجتمع المستهدف في هذه الدراسة يشمل جميع أطباء الأشعة ومعهد ماساتشوستس للتكنولوجيا العاملين في النظام الصحي الفلسطيني، الدراسة تم اختيار العينة عشوائياً وتكونت من 235 من أخصائيي الأشعة ومعهد ماساتشوستس للتكنولوجيا العاملين في الجهاز الصحي الفلسطيني، معظمهم من الذكور (72.3%)، بينما بلغت نسبة الإناث (27.7%)، وكان معظم المشاركين في عينة الدراسة من فنيي التصوير الطبي (80.9% منهم فقط 6.4% استشاريين أشعة و12.8% مقيمين أشعة.

النتيجة: كشفت النتائج عن وجود نقص في البروتوكولات الموحدة التشخيصية والعلاجية لجميع الإجراءات بنسبة 75.7%، ولم يتم التأكد من التنفيذ الموحد للبروتوكولات، ولم يتم رصد الانحرافات بنسبة 70.6%، ولا يوجد وصف وظيفي واضح يحدد الأدوار والمسؤوليات من الموظفين في إدارة الحصول على الصور، وتمثل جودة الصورة 71.9%، قسم التصوير الطبي يفتقر إلى مسؤول الوقاية والسلامة من الإشعاع (RSO) بنسبة 72.8%، لم يتم تقديم شرح وإرشادات حول إجراء التصوير لمتلقي الخدمة قبل الإجراء (65.1%)، سلامة المرضى لا تحظى بالأولوية (65.5%)، لا يتم التحقق من جودة الصور من قبل طاقم الأشعة والتصوير المدربين، (65.5%)، فحوصات السلامة قبل الدخول في إجراءات التصوير الطبي لا يتم إجراؤها بشكل مستمر (62.6%)، المراقبة

المستمرة لم يتم ضمان متلقي الخدمة الفاقد للوعي أو المخدر أثناء الإجراء (62.6%) ولا يتضمن طلب الإحالة من قبل الطبيب المُحيل المعلومات السريرية ذات الصلة والتاريخ (68.5%)، ولا يوجد إجراء موثق للحالات العاجلة وغير المتوقعة مرضى الطوارئ (68.9%)، معلومات الفواتير غير موثقة أو معروضة، قبل الفحص (68.1%)، طلب الإحالة لا يتضمن توضيحاً لسلامة الإناث (66.8%)، لم يتم ربط المعلومات الطبية والعلاجية بالمعلومات السابقة التفاصيل السريرية والمخبرية والإشعاعية ذات الصلة في تقرير الإحالة65.1) ٪.(

الاستنتاج: تشير نتائج الدراسة الحالية إلى وجود نسبة أعلى بكثير من المواقف السلبية (لا توجد إجابات) تجاه بروتوكولات طلب الإحالة في قطاع الصحة العامة (المراكز الطبية أو المستشفيات) مقارنة بكل من المنظمات غير الحكومية والقطاع الخاص.

التوصيات: يوصى بتوحيد بروتوكولات التصوير الطبي داخل النظام الصحي الفلسطيني، إلى جانب ضمان التنفيذ المتسق لهذه البروتوكولات ومراقبة أي انحرافات، ويقترح أن تتضمن طلبات الإحالة معايير موحدة لمعلومات المريض.