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Evaluation of Advanced Medical Imaging Services at Government Hospitals-West Bank

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ABSTRACT

***Background**: Medical imaging services provided to patients in the CT and MRI unit are essential to reach the best results for assessing their health conditions.*

***Objective**: The aim of this study was to evaluate the client's satisfaction and medical services of the CT and MRI at private centres and hospitals in the West Bank- Palestine.*

***Methods**: The study was based on triangulated design; checklist, interview and questionnaire. The checklist is made by researchers to evaluate CT and MRI units' design. The researchers interviewed 100 patients who were imaged in CT and MRI units to assess their satisfaction with the provided medical service. The questionnaire was distributed to 28 radiologic technologists (RTs) to know their characteristics and to assess the extent of the RTs commitment to the medical services.*

***Results:** Findings revealed that from the client's perspective: Inferential analysis shows that there was a statistically significant difference at the level of significant $\alpha \leq 0.05$ in reception and waiting with respect to the residence. While there is no statistically significant difference at ($\alpha \leq 0.05$) in the evaluating of reception and communication in the radiology department with respect to gender and employment status. Meanwhile, the results showed there is a relationship between satisfaction and the monthly income of participants. The study showed MRI units track the international standard system in structures and occupational safety while about 87.5% of CT units follow occupational safety and about 65% of the structures.*

***Conclusion:** Through the study, the shortage in the CT and MRI units, and RTs compared to other countries became clear. The deficiency was observed in radiological protection techniques presented to patients and RTs.*

Keywords

Occupational safety, Medical imaging Services, Radiologic technologists, MRI, CT.

Introduction

The developments in medical modalities can be used to detect the internal anatomical parts and different diseases in the human body [1-3]. Radiography is a part of medical imaging modalities, which uses x-rays to image the internal parts of the body through the X-ray penetration and attenuation process inside the body. These rays are absorbed into the body at different rates depending on the organ density, thickness part, and the electron density of the organ [4,5] The bone and dense tissue are clearly visualized during this modality. During the imaging process in various medical imaging modalities, miscellaneous medical services are provided to patients to reach the best result during the different imaging stages [6-8].

Medical imaging services have expanded dramatically in the past decades, thereby increasing knowledge of radiographic imaging [9]. Medical imaging services include several methods that depend on the type of medical imaging (ionizing or non-ionizing) such as Conventional Radiography, Fluoroscopy, Computed Tomography (CT), Mammography, Panoramic, Gamma Camera, Positron Emission Tomography (PET), Ultrasound imaging, and Magnetic Resonance Imaging (MRI) [10-12].

Medical imaging services include medical services for both patients and workers. Medical services for patients include patient comfort and this can be applied by designing the medical imaging department. Also, The service in medical imaging includes dealing with the patient in a timely manner, providing comprehensive information about the examination to be performed, rapid and responsive interventions in case of emergency, and finally, the immediate delivery of patients' reports accurately by qualified radiologists in an effective manner [13-15]. There must be reciprocal communication between patients and medical service providers, as well as a facility and individual capacity to provide services that will ensure sustainability.

In Palestine, medical imaging systems have evolved from conventional radiography to computerized and digital imaging radiography. Recently, the radiography systems have promoted to include magnetic resonance imaging (MRI) technologies of 1.5 Tesla, 128-Computed tomography (CT), digital mammography systems, digital fluorescence imaging systems, and ultrasound imaging. These systems alter the medical imaging services provided to the patient [16-18]. Through CT, complex examinations are performed, such as computed tomography of angiography (CTA), CT of intravenous pyelography, and cholangiography. With the noticeable increase in such examinations, and the complaints of these patients about the quality of medical imaging services provided, the importance of providing high-quality services to the patients increased [19,20].

However, there is a lack of empirical evidence to ensure the provision of distinctive medical imaging service quality to the patients in order to establish and develop the medical imaging strategies and systems in Palestine. Moreover, the Ministry of Health in Palestine is committed in providing patient-centred and medical service providers to the governmental hospitals. This service is targeted towards the best medical imaging service quality, and results-oriented. Therefore, the aim of this study is to evaluate the advanced medical imaging services in governmental hospitals located in the West Bank – Palestine.

Materials and Methods

Study design

This study was based on a quantitative descriptive analysis using a cross sectional study with a triangulated design (quantitative and qualitative).

Study Population and Data Collection

The current study was based on several aims, including: examining the interior design of the radiology department, the extent of patients' satisfaction with the services, in addition to evaluating the human resources working in the department. These resources are valued on international standards and reports. All clinics have a medical imaging service(s), including, CT and MRI at the medical imaging department of the government hospitals distributed throughout the West Bank, consisting of 7 hospitals. The authors preferred to keep the names of the hospitals anonymous for not revealing the names of RTs in those hospitals.

Data Collection: Quantitative Study

The quantitative method was based on radiologic technologist (RTs) working on advanced imaging techniques. The questionnaire was distributed to 28 RTs, it included personal information such as gender, age, years of experience, educational qualification, and type of device which working on it. A 5-point Likert scale questionnaire was used to determine the extent of the RTs commitment to the medical services. The number of patients received within 24 hours were determined through the questionnaire. The data was analysed using SPSS software version 25.

Data Collection: Qualitative Study

Qualitative method was used to assess the extent of patients' satisfaction with the medical services provided to them, by conducting interviews with 100 patients after carrying out the required exams. Through the interview, the aspects of the medical service provided to patients were identified. An ethical approval was made for each patient to conduct the interview after explaining about the importance of the information he will provide, the purpose of the interview.

At the end, the study provided a checklist based on international standards "Australasian Health Facility Guidelines", "radiological protection Institute of Ireland" and "National Health Services" to check the medical services provided to the patients. The researchers through the observation evaluated the checklists.

Results

The number of RTs in the advanced medical imaging radiology (CT and MRI) reached to 28 RTs. Distributed over 7 government hospitals, which covering all parts of the West Bank. The number of MRI devices included 42.8% of West Bank hospitals, while all hospitals contain CT devices. Of the 28 RTs, 17.9% of them work on the MRI devices and 82.1% of RTs work on the CT devices.

Figure 1 shows the number of MRI and CT scans per 100,000 inhabitants in different countries. The current reading in West Bank hospitals found a clear difference in the number of devices compared to these countries especially with Japan, United States, and Australia [21]. However, the number of devices is somewhat close to the Israel readings. The current study illustrates the great decrease in the number of advanced medical imaging devices, especially in the MRI.

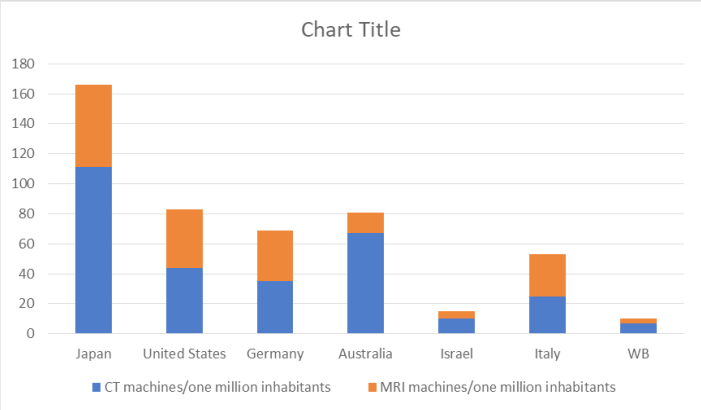

Figure 1: Numbers of CT and MRI machines/1000,000 inhabitants, 2019.

The number of questionnaires distributed was 28 and the number of questionnaires received was 28 with a response rate of 100%. The first section is concerned with the demographic characteristics of RTs, where age groups have been collected. In addition to gender, educational qualification and finally years of experience that they have.

Table 1 shows that 92.9% of the respondents were males and the 7.1% were females. The table also clarifies that the highest age groups were over 40 years old, at a rate of 46.4%, and the lowest age group was less than 25 years at 3.6%. The second highest age group was between 30-35 years with 17.9%. The RTs ages was provided to facilitate the department's management process, because the medical services need efficiency, experience, and great effort to reach the best service.

Table 1: The RTs Characteristics Distribution with Different Variables (N= 28).

Variables		Frequency	Percentage %
Age groups	20-25	1	3.6
	25-30	6	21.4
	30-35	5	17.9
	35-40	3	10.7
	>40	13	46.4
Gender	male	26	92.9
	female	2	7.1
Qualification	Diploma	2	7.1
	Bachelor's degree	20	71.4
	Master's degree	6	21.4
Experience	<5	5	17.9
	5-10	5	17.9
	10-20	7	25
	>20	11	39.3

The majority of the RTs hold bachelor degrees around 71.4% and that the minority of them hold diploma certificates 7.1%, and that a proportion of 21.4% the RTs who are trying to develop themselves by obtaining a master's degree (Table 1). The RTs responsibilities and the development were evaluated by the questionnaire. Table 2 displays the distribution of RTs in adhering to the medical services. The table shows the extent of the commitment of the RTs in their responsibilities. The highest percentage was 77.2% of the commitment in conducting laboratory tests before carrying out the examination. Maintaining the hygiene of the equipment and the workplace clean was in a rate of 68.6%. Furthermore, a 62.8% of the RTs repeat the wrong exams while 67.2% of them take the patient's information completely. On the other hand, 59.2% of all RTs were trying to develop themselves through advanced courses on devices or even developing themselves in the field of education, such as finishing a master's degree, and 65.8% were trying to develop the department where they work.

Table 2: The Extent of the RTs Commitment to the Medical Services.

Variables	Item	Percentage
RT responsibilities	work cleaning	68.6
	re-examination the wrong images	62.8
	take the patient information	63.5
	give patient the information about the exam	67.2
	laboratory tests before the examination	77.2
Development	Self-development	59.2
	Development of the work environment	65.8

Besides, 100 patients were asked about their satisfaction with the medical service provided to them. Table 3 illustrates aspects of the questions were asked to the patients. It is clear from the table that 75.8% of patients acknowledge that the RTs. 71% of patients report that they use the change cubicle to prepare themselves for the examination, and 71.4% of patients report that the imaging device is clean and the device is comfortable for them during the examination respects them. 71% of patients report that they use the change cubicle to prepare themselves for the examination, and 71.4% of patients report that the imaging device is clean and the device is comfortable for them during the examination. In contrast, only 37.2% of patients report they are satisfied with the waiting time before a test, and only 25.8% of patients are satisfied with RTs communicating with them. Whereas, only 57.2% of the patients admitted they used a protective lead in the gonadal region.

Table 3: The Distribution of Patient Satisfaction with the Medical Service Provided.

Variables	Item	Percentage
Patient Respect	Effective Communication with RTs	25.8
	Use the dressing room	71
	Respecting the patient's characterization	56.5
	Cleanliness and comfortability of the equipment	71.4
	Take the patient's medical history	45.8
	Waiting time before the procedure and waiting time for getting the result	37.2
	Privacy	75.8
	Provide patient history for radiologist	48.6
Using protection device	Protective Apparel (like aprons)	59.2
	Gonadal Shielding	57.2

Figure 2 represents the number of RTs working on the CT device on the morning and evening shifts, with the number of patients receiving during working hours. It is clear that RTs in most governmental hospitals receive 10-15 cases during a single shift, and a small number of them receive 5-10 cases per shift, while a portion of them receives more than 15 cases per day.

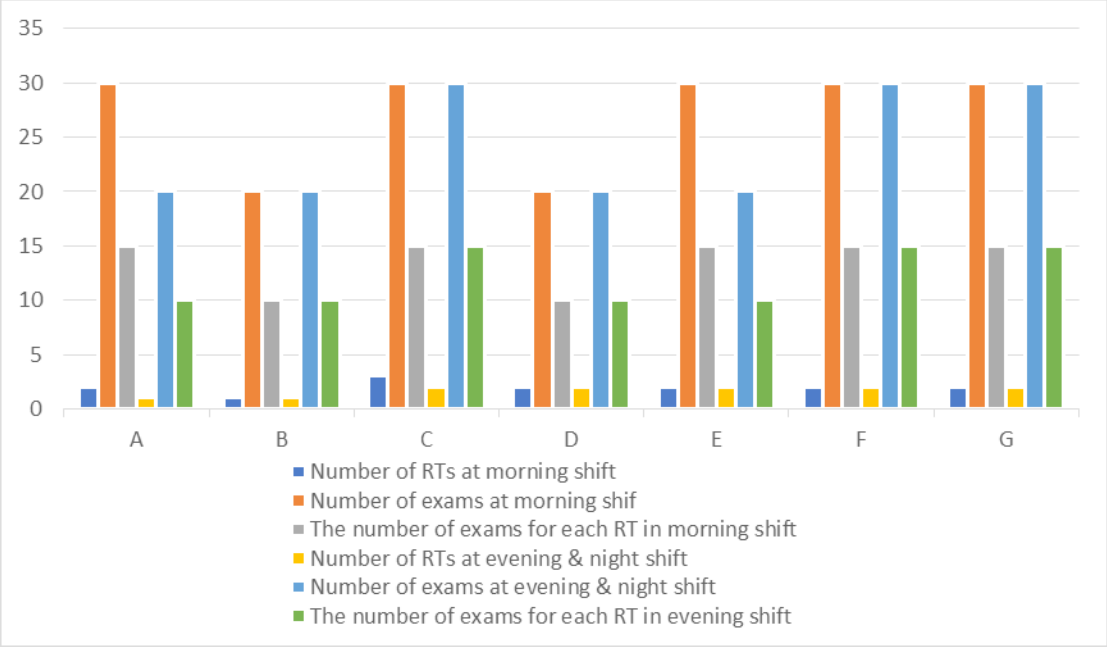

Figure 2: The Number of RTS Working on CT Devices to the Number of Daily Examinations.

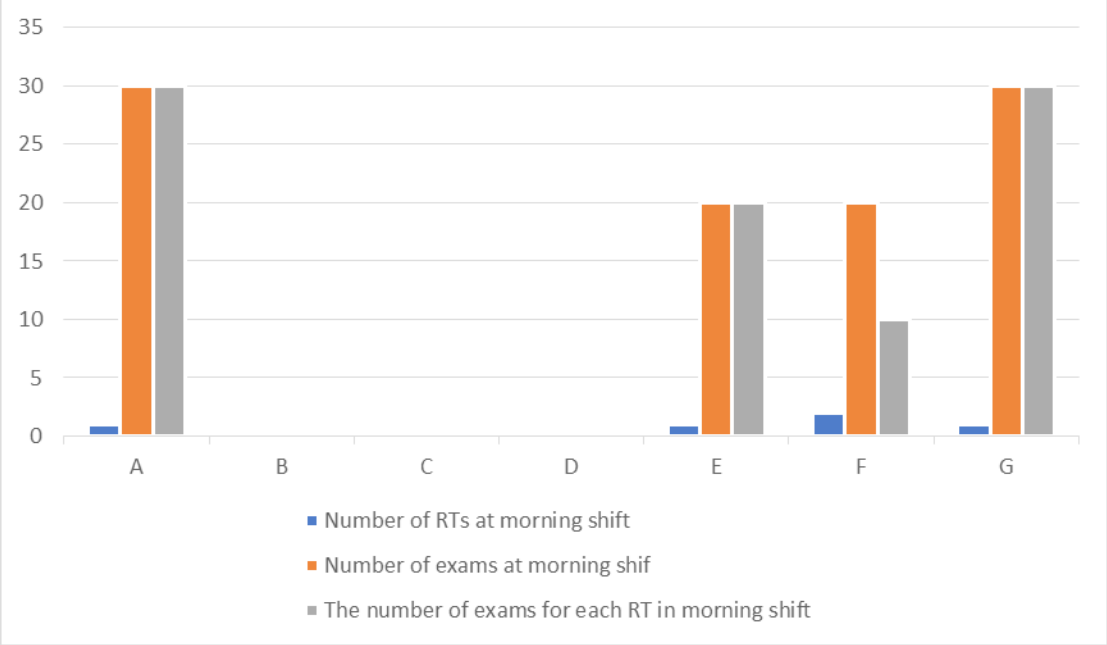

Figure 3: The Number of RTS Working on MRI Devices to the Number of Daily Examinations.

Figure 3 shows the number of RTs working on the MRI machine to the daily number of patient cases during morning shift. It is evident that each RT acquired the MRI exam for 10-15 patients during one shift.

Through Table 4, which shows the design structure of the CT room in various governmental hospitals, 75% of the CT rooms follow the recommended standard size and have change cubicles. Around 87.5% of the control rooms track the standard room size. However, only 12.5% of the CT units have recovery rooms and 37.5% of them have an internal toilet. All CT units contain a good ventilation inside room and patient entrance follows the global guidelines [22].

Table 4: CT Structural Checklist at Governmental Hospitals.

Item	Total	
	Yes%	**No%**
Room size ≥ 42 m^2	75	25
Is there control console area ≥ 6 m^2	87.5	12.5
Is there a toilet inside the room?	37.5	62.5
Is there a recovery room for patients?	12.5	87.5
is there a change cubicle?	75	25
Are the patient's entry ≥ (150- 180cm)?	100	-
Is there a drainage sewage?	37.5	62.5
Is their ventilation in room?	100	-

From Table 5 it is clear that CT units at the governmental hospitals contain a ventilation room and all rooms follow the global systems in the lead thickness, the height of the lead wall, the door lead-shielded, and contain a lead apron [23,24]. All units contain adequate lighting that works well. On the other hand, about 75% of the CT units contain radiation-warning signs on the door and protective glasses. Moreover, only 37.5% of the CT units contain gonadal shields, 87.5% contain thyroid shields, and half of the units do not contain protective gloves.

Table 5: Occupational Health Safety Checklist in CT Device at Governmental Hospitals.

	Total	
	Yes%	**No%**
Is there ventilation in room?	100	
Is the room checking by competent authorities	100	
Are room walls shielded with lead-thickness? 3 mm? (STD)	100	
Is the height of lead walls? 2 m? (STD)	100	
Are doors lead-shielded?	100	
Is there a lead apron?	100	
Is there an air conditioner	100	
If yes; is it working?	100	
Is there adequate light?	100	
Are there lead protective glasses?	75	25
Is there a radiation warning signs on the door?	75	25
If yes, does it operate during imaging?	50	50
Is there a gonadal shielding?	37.5	62.5
Is there a thyroid collar?	87.5	12.5
Are there lead protective gloves?	50	50

The study also examined the structure of MRI department. Table 6 shows all MRI units follow the international standards. Regarding to the services, all units have headphones for the patient and Intercom system between RTs and patients, and 66.7% of the units have special form for procedures.

Table 6: MRI Structural and Services Checklist at Governmental Hospitals.

		Total	
		Yes%	No%
Structure	Is a room size 3 ≥ 42 m^2	100	
	Is there control console?	100	
	Is control console area ≥ 10 m^2	100	
	Is there a waiting room?	100	
	Is there an air icon?	100	
	Is there a comfort light?	100	
	Is there a reception?	100	
	Is there a change cubicle?	100	
	Is there a toilet?	100	
Services	Is there a headphone for patient?	100	
	Is there a communicating system "intercom" between patient and RT?	100	
	Is there a special form for procedures?	66.7	33.3

In Table 7, it shows all MRI units possess occupational health safety (OHS) including room ventilation, air conditioner, and adequate light.

Table 7: Occupational Health Safety Checklist in MRI Device at Governmental Hospitals.

		Total	
		Yes%	**No%**
Occupational Health Safety (OHS)	Is there ventilation in room?	100	
	Is there an air conditioner?	100	
	If yes; is it working?	100	
	Is there adequate light?	100	
	Is there a safety guidelines Panel before entering scanning room?	100	
	Is the room checking by competent authorities?	100	

Discussion

This study is considered as the first study, which provides the empirical evidence on the quality of medical imaging services in Palestine. As this article measured the quality of medical imaging services in 7 governmental hospitals in the West Bank. This study showed an overall decrement in the medical imaging service quality. As the medical service, providers did not provide the best quality, and therefore, they would not reach the desired services for patients in the medical imaging department. On the contrary, patients' satisfaction with respecting their privacy was recorded during the imaging process.

The current results showed the extent of commitment of workers in the field of medical imaging CT and MRI between 62.8-77.2%. The study also revealed that the rate of self-development workers was between 59.2-65.8%. Another study shared the same results in terms of medical imaging services relation to medical workers [25].

Regarding to RTs gender, the current results are very similar to Sunshine et.al [26] and Abushab et.al [27]. The reason for this percentage is that decision-makers avoid employing females as RTs due to the effects of pregnancy (feeding and maternity leave). In addition, females prefer to work in the morning shift than in the evening and night shifts.

The study showed that most of the participants and workers in medical imaging hold bachelor's degrees. The reason for these percentages may be because of most universities in the world have a bachelor's degree in medical imaging, and the fact that local universities (Palestinian Universities) give medical imaging program with a minimum of four years to be able to work in the hospitals.

In addition, the study showed that RTs in most governmental hospitals receive 10-15 cases during a single shift. The great pressure on the RTs in such cases affects their job performance in general, which means affecting the quality of medical service provided to the patients [28] .

In addition, the study showed that each RT acquired the MRI exam for 10-15 patients during one shift. This painstaking work prevents him from providing the best medical services to the patient, especially in cases that need a long time for such as abdominal

imaging, breast imaging and other exams. If we assume that the number of hours spent by the RT in a single shift is 7 and receive 12 patients on average, this means each patient has half an hour per exam, which is the minimum time for actual MRI exam between 20-90 min [29]. Thus, it will be very challenging for the RT to perform other tasks assigned to him such as patient preparation and explaining the examination steps to the patient and other tasks. It seems clear that work-load pressure not only affects the medical service to the patient receives, but also affects his safety [21].

However, there are some limitations to the current study where different aspect and consideration such as patient centeredness, timeliness, capacity and sustainability in the qualitative study, and effective communication, equity, and safety should be taken into in the quantitative study.

Conclusion

Medical imaging services are very important for both RTs and patient to perform the best service. The appropriate design of stratified CT and MRI is an important part of increasing safety and service quality for patients. The number of CT and MRI devices is still not sufficient to cover the entire population of Palestine compared to other countries. Increasing the workload for the RTs negatively affects their performance of the medical services provided to the patients. There is a great need to provide a greater number of RTs to work in the CT and MRI units. In the CT unit, almost two-thirds of the hospitals follow the international standards in structure, and approximately 80% follow OHS, while all units in the MRI follow the global systems in both structure and OHS.

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