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Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals-Gaza Governorates

Basma Talat Al-Agha

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Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals-Gaza Governorates

Prepared By :

Basma Talat Al-Agha

Bachelor in Diagnostic and Therapeutic Radiology- Al-Azhar University _Gaza

Supervisor: Dr. Yousef Ibrahim Al Jeesh, PhD

Associated Professor in International Public Health Medicine

Islamic University - Gaza

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Dedication

To my father spirit, Allah blesses his soul, who taught me how to love knowledge.

To my affectionate mother that I can't survive without her invocation,

To my brothers and sisters,

To Mr. Jamil Alagha for his unlimited patience, support and continuous motivation,

To my loyal and real friends who never stopped encouraging me,

To everyone who contributed to get this study a reality.

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Declaration

I declare that this research is my own work and that no part of it has been copied from any other previous works on the subject, except in such instances where acknowledgment has been duly made.

Signature

Basma Al-Agha

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Abstract

Musculoskeletal disorders (MSDs) are widespread public health problem that affects quality of life and productivity. This study aimed to determine the prevalence and risk factors of MSDs among radiological technologists (RTs) working at governmental hospitals in Gaza Strip. The design of this study was descriptive, analytical, cross-sectional one. The sample of this study consisted of 172 technicians (136 male and 36 female). The researcher used constructed self-administered questionnaire for data collection. A pilot study on 15 RTs was conducted to test validity and reliability of the study instrument. Different statistical procedures used for data analysis including cross tabulation, percentage and Chi square.

The results showed that the overall prevalence of MSDs among study participants was 75.6%. MSDs were higher among female RTs (91.7%) compared to male RTs (71.3%). Back was the dominant site for MSDs and it constitutes 31.5%and stiffness was the dominant type of pain (40.76%). Eighty three point five percent of male and 84.8% of female RTs complained of moderate to severe MSP. The majority of RTs (79.2%) have intermittent episodes of pain and 56.2% of RTs complained of pain for more than 6 months. Regarding pain onset, 90.0% of RTs developed pain after they were employed in radiology department and 10.0% of RTs had MSP before working in radiology department. There were no statistical significant differences in MSP in relation to gender, age and years of experience. The highest complain of MSP (61.0%) was among RTs aged 40 years and less and the lowest complain (3.0%) was among RTs aged 51 – 59 years, 44.7% of those who complained of MSP were employed for 1 – 7 years. Among those who complained of pain, 82.3% asked for medical advice. Bending and twisting were the major risk factors for MSDs (88.4%) followed by lifting heavy objects and cassettes (85.5%), lifting and transferring patients (77.9%) and psychological pressure (77.3%), while sitting for long time (32.6%) and office work (19.2%) were the lowest risk factors as perceived by RTs. Concerning workplace environment, 58.7 % of RTs reported that lighting in their workplace was unsuitable, 54.6% of RTs reported that floor was unsuitable and 58.1% of RTs reported that staff number was unsuitable. The study concluded that workplace modifications is needed (lighting and floor) beside the need to increase the number of qualified staff. Priority suggestions to avoid MSDs were decreasing the number of radiology procedures performed each day, distributing assignments fairly between staff and avoiding lifting heavy objects.

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List of Abbreviations

CCOHS	Canadian Center for Occupational Health and Safety
CT	Computed Tomography
GS	Gaza Strip
LBP	Low Back Pain
MOH	Ministry Of Health
MRI	Magnetic Resonance Imaging
MSDs	Musculoskeletal Disorders
MSP	Musculoskeletal Pain
NGOs	Non Governmental Organization
NOISH	National Institute for Occupational Safety & Health
OSHA	Occupational Safety & Health Administration
PCBS	Palestinian Center Bureau of Statistics
PHC	Primary Health Center
RTs	Radiological Technologists
UNEP	United Nations Environment Program
UNRWA	United Nations Relief and Works Agency
USDL	United States Department of Labor
US	United States
WB	West Bank
WHO	World Health Organization
WRMSDs	Work Related Musculoskeletal Disorders

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Chapter One

Introduction

1.1 Back ground

Musculoskeletal disorders (MSDs) are an important and costly occupational health problem with consequences for workers, employers and society. About 40 million workers are affected by work-related MSDs. Almost a quarter of the European workforce report that they have experienced muscular pain in their neck, shoulders, upper limbs and about one in every three suffers from low back pain (LBP). Within the European Union, MSDs are the single most common cause of sickness absence from work, early retirement and disability payments.

It is estimated that the direct annual costs of the MSDs account for 2% of the European gross domestic product (Bevan, *et al*. 2009). Work related musculoskeletal disorders (WRMSDs) are major public health problems and the most serious in the field of occupational health. These disorders leading to disability, increased absenteeism and produce significant costs in treatments and compensations (Magnago, *et al.* 2010). They are among the most costly health care problems facing society today (Marras, *et al*. 2009).

MSDs affect the body's muscles, joints, tendons, ligaments, bones and nerves. Most of them caused either by the work itself or by the employees working environment. Typically, MSDs affect the back, neck, shoulders, upper limbs and less often affect lower limbs (OSHA, 2010). The world Health Organization (WHO) has characterized work-related diseases as multi factorial to indicate that a number of risk factors (e.g., physical,

organizational, psychological, individual, and socio-cultural) contribute to causing these diseases (WHO, 1985).

It has been shown that MSDs represent 40% of all chronic health problems, 54% of long term disability and 20% of health care utilization (Badly, *et al.* 1994). Every year in the European Union (EU), there are 5,720 fatal work-related accidents and millions of people injured from work place (OSHA, 2010). In the United States (US), MSDs are the most frequent complaint where about 33% of adults are affected by their signs and symptoms including limitation of motion or pain in joints or extremity and its prevalence generally increases with age (David, 2002). In addition, Skinner (1996) found that LBP is common in the US where about 80% of population will experience LBP during adulthood. An interesting study was done by Micheal, *et al.* (2008) and reported that lifetime LBP prevalence was 70.9% and direct patient contact that includes lifting and transferring patients may be an important risk factor for LBP among health professionals working in Kuwait Hospitals.

Locally, musculoskeletal pain (MSP) was studied among laboratory technicians working at governmental hospitals in Gaza Strip (GS) and it was founded that 68.7% of them were suffering from musculoskeletal pain and females suffer more than males (El-Astal, 2010). Another study revealed that the prevalence of LBP among health professionals at UNRWA health departments in GS was about 70.5% and the prevalence increase with age (Abu Rayya, 1999). Another study showed that the prevalence of LBP was 70.6% among operating room nurses in governmental hospitals in GS (Al Nawajha, 2011). Among

Academic and administrative staff at Islamic University in Gaze, muscle spasm was the dominant type of neck pain, and in 88.2% of the study participants the nature of pain was interrupted (El Keshawi, 2008).

MSDs comprises significant injuries and disability among radiological technologists (RTs), risk factors include lifting cassettes, carrying patients, transferring mobile devices, contact stress (wearing lead apron), awkward posture, force, static postures and others (Chavez, 2005). Lorusso, *et al*. (2010) found that 60% of Italian X-ray technologists' students have LBP, 20% have neck pain and 21% have shoulder pain.

In Gaza, governmental hospitals there are many factors that contribute to development of MSDs and pain / discomfort among RTs since they face many physical, psychological and occupational hazards. Therefore, this study was conducted to identify the most common MSDs and consequent MSP through determining its prevalence, characteristics, common risk factors and associations with demographic variables.

1.2 Research Problem

MSDs are widespread in occurrence with significant costs and affect quality of life. Many studies revealed that MSDs are a real problem in different specialties among health professionals (Al-Nawajha, 2011; El-Astal, 2010; Lorusso, *et al*. 2010). They represent an increasing problem for the employees as they cause suffering, disability, pain and or loss of

job. For the employer, they reduce business efficiency, productivity and increase social security costs (El Keshawi, 2008).

Excess compliant from MSDs have many negative consequences on the performance of many health professionals. RTs having over workload, poor working environment, psychological stress, uncomfortable design of workplace, sudden movements during work and job type may result in real impact on developing MSDs. Therefore, this study is going to identify the most common MSDs among RTs at governmental hospitals in GS to provide valid information about the prevalence and risk factors of MSDs in order to provide helpful recommendations to avoid or reduce work-related injuries and diseases.

1.3 Justification of the study

RTs are trained health professionals responsible for performing diagnostic imaging procedures and their tasks include preparing the patients for radiological examinations, positioning and immobilizing them on examination table, moving the equipments over the patients, lifting heavy cassettes and developing X-ray films. All of these can contribute to MSDs, causing pain, suffering and disability. Therefore, MSDs are considered serious occupational health problem that have negative impact on their performance. According to the researcher's knowledge, some studies regarding MSDs among health care providers were carried out in GS, but only one study among UNRWA clinics RTs in GS was conducted by Abu Rayya (1999). Although, there is frequent complaint from LBP, neck pain and shoulder pain, some of RTs were referred to physiotherapy clinics and other have

sickness absence from work for many days according to physician's advice. In Canada, it was found that 83% of RTs have LBP (Kumar, *et al.* 2004). Another study showed that the prevalence of MSDs among X-ray technologists working at thirteen hospitals in South Italy was 76% (Lorusso, *et al*. 2007).

Therefore, this study highlighted the most common MSDs in relation to some variables among RTs working at Gaza governmental hospitals. The study results also helped in implementing modification to alleviate risk factors and management strategies that may help to reduce or prevent these disorders.

1.4 Objectives of the study

1.4.1 General objective

The general objective of the study is to know the most common musculoskeletal disorders among radiological technologists at Gaza governmental hospitals in relation to some variables.

1.4.2 Specific objectives

- To determine the prevalence of musculoskeletal disorders among radiological technologists at Gaza governmental hospitals.
- To describe the characteristics of musculoskeletal pain (site, severity, intensity, type, onset, duration and nature).

- To identify the association between musculoskeletal disorders and socio-demographic factors (age, gender and years of experiences).
- To identify risk factors contributing to musculoskeletal disorders among radiological technologists.
- To describe workplace characteristics as perceived by radiological technologists.
- To suggest recommendations to decrease musculoskeletal disorders.

1.5 Questions of the study

- What is the prevalence of musculoskeletal disorders among radiological technologists at Gaza governmental hospitals?
- What are the characteristics of musculoskeletal pain among radiological technologists (site, severity, intensity, type, onset, duration and nature)?
- Is there an association between musculoskeletal disorders and gender of radiological technologists?
- Is there an association between musculoskeletal disorders and age of radiological technologists?
- Is there an association between musculoskeletal disorders and years of experience?
- What are the risk factors for developing musculoskeletal disorders among radiological technologists?
- How do radiological technologists perceive their work environment?
- What are the main suggestions to alleviate musculoskeletal disorders among radiological technologists?

1.6 Context of the study

This study was conducted in GS governmental hospitals; therefore, the researcher presents some background information about the demographic, geographic context, population, Palestinian economy, health situation that have impact on the quality and the utilization of the health services. In addition, some information about the place of the study which include all governmental hospitals in GS including: Al-Shifa, European Gaza Hospital, Al-Aqsa Martyrs, Al-Emaraty, Al Nasser children's, Specialized children's hospital, Kamal Adwan, Abu Yousef Al-Najjar, Nasser medical complex, Beit Hanoun, and Aldorra pediatric hospital are presented.

1.6.1 Demographic context

Palestine has an important geographical and strategic location; it is situated on the eastern cost of the Mediterranean Sea, bordered by Lebanon on the North, Syria and Jordan on the East, the Gulf of Aqaba on the south and by Egypt and the Mediterranean Sea on the West. Now, Palestinian National Authority comprises the two geographically areas, the West Bank and Gaza Strip. Its position on the crossroads from Africa to Asia made it a target for occupiers and conquerors over the centuries. The last of these was Israel who occupied the GS in 1967 (MOH, 2006).

In 2009, the Palestinian Central Bureau of Statistics (PCBS) estimated the number of population in Palestinian territories as 3.9 million and the distribution of Palestinian population is as follows: 2.4 million (61.5 %) in the west bank and 1.5 million (38.5 %) in

the Gaza Strip, 755,000 males and 732,000 females. The percentage of urban population mid-2009 was about 73.7%, while the percentage of the rural population and camps areas was 17.0% and 9.3% respectively.

41.9 % of the Palestinian population are under 15 years old (40 % in west bank and 44.9 % in the Gaza Strip), while 3 % are above 65 years old (3.4% in west bank and 2.5% in the Gaza Strip). The highest populated governorate in the Gaza Strip is Gaza Governorate (519,000) and the lowest is Rafah (182,000) (PCBS, 2009).

1.6.2 Socioeconomic context

The Palestinian economy refers to the economy of the Palestinian territory; including GS, WB and East Jerusalem. Current political situation and the siege imposed against GS have severely damaged the Palestinian economy. According to PCBS, 23.8 % of the households in the Palestinian territories in 2007 were suffering from deep poverty according to consumption patterns (13.9% in the WB, and 43.0% in the GS), while according to income patterns, 48.0% of households were suffering deep poverty (37.3% in the WB, and 69.0% in the GS), (PCBS, 2009). Nowadays, 80% of families in Gaza currently depend on humanitarian aid. This decline results from exceptional levels of poverty and the inability of a large majority of the population to provide basic food. As a result, humanitarian aid organizations increased food aid dramatically to meet the needs of this increasingly poor population. In 2008, over than 1 million people; about three-quarters of Gaza's population depend on food aid (Human Rights Council, 2010).

1.6.3 Environmental status

Palestinian environment is facing serious threats , such as the alarming population growth, limited land resources, long term isolation as a result of the regional political circumstances . This had caused serious deterioration , fast depletion and contamination of our environmental resources which lead to health risks among citizens (Lubbad, 2006). Handling of hazardous waste and infectious waste mixed up with solid waste is a critical problem which causes environmental and health risks in the Palestinian Territories (UNEP, 2003).

1.6.4 Palestinian health care system

Over the past years, the Palestinian health care system had been developing in dynamic way to face the instability of the Palestinian situation. The four major providers of health care services in Palestine are: the Palestinian National Authority represented by MOH, UNRWA, NGOs, and the privet sector. MOH is the main health care provider; it provides primary, secondary services and purchased some services from privet providers domestically and abroad (MOH, 2006). MOH plays the main role in providing and controlling immunizations scheme, public health activities, licensing and registration of health facilities. Health care financing is mainly provided through the government, apart from the out-of pocket health financing which is the first source of health financing in

Palestine. UNRWA provides primary health care (PHC) services to the refugee population through 20 PHC centers. The NGOs sector is extensive from missionary hospitals, to facilities supported by international organization, to community health centers, it operates about 50 centers. The privet for – profit health sector also provide the three levels of care through wide range of practices (WHO, 2009).

1.6.5 MOH hospitals

The MOH owns and operates 25 hospitals (13 in GS and 12 in the WB), furnished with 2,815 beds (1,499 in GS and 1,316 in the WB). Of these hospitals there are the general hospitals with 2,163 beds (1,199 in GS and 964 in WB), two psychiatric hospitals with 319 beds (280 in WB and 39 GS), one ophthalmic hospital in GS with 31 beds and two Pediatric hospitals in GS with 222 beds (MOH, 2006).

1.6.7 Governmental radiology services in Gaza Strip

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

All of eleven hospitals provide Ultra-Sonography, routine X-ray and is suppose to provide fluoroscopy procedures in their departments also but there are some defects in some hospitals, while four of these hospitals have Computed Tomography (CT) units and three hospitals have mammography units. Only two hospitals have panorama units. Magnetic

Resonance Imaging (MRI), which is a non ionizing radiation is available only in Naïf Center.

Regarding nuclear medicine and radiotherapy ,there are some machines at Naïf Prince center in Shifa hospital, but they have not been operated because of Israeli siege imposed on Gaza strip. Only 14 of the primary health care clinics and centers have a routine X ray services.

According to the records of hospitals directorate general about 478600 radiological diagnostic procedures were done in 2010; 58788 of them US and 13894 CT procedures. Radiology departments has noticed that there is an increase in the frequency of radiological procedures year after year and there is no rational use for them (Directorate general of hospitals, 2010).

1.7 Definition of terms

Musculoskeletal disorders (MSDs)

MSDs refer to a condition that can affect the body's muscles, joints, tendons, ligaments, and nerves. Typically, they affect the back, neck, shoulders and upper limbs; less often, they affect the lower limbs (OSHA, 2010).

The researcher defines musculoskeletal disorders operationally as any condition that lead to pain or discomfort in the neck, shoulders and back at any time during the last year.

Musculoskeletal pain (MSP)

Pain that affects the muscles, ligaments and tendons, along with the bones (Chris, *et al*., 2002).

The researcher defines musculoskeletal pain operationally as any complaint of discomfort or unpleasant sensation of varying severity that occurs in the neck, shoulders and back that result from work conditions.

Risk factors

Any characteristic of a person (such as age), a situation (such as the severity of a traumatic event), or a person's environment (such as family life) that increases the likelihood that that person will eventually develop a disorder (Matthew, 2008).

The researcher defines risk factors operationally as the sum of poor conditions in the workplace that may lead to musculoskeletal discomfort or pain including work overload,

lifting heavy objects, lighting, ventilation, height of working tables / disks, space and crowd.

Radiology department

Hospital department which is responsible for the administration and provision of X-Ray diagnostic and therapeutic services (www. MedConditions.net).

The researcher defines radiology department operationally as special place in the hospital designated for performing diagnostic procedures by using X-ray, computed tomography, mammogram, panorama, ultra sound, fluoroscopy or magnetic field.

Radiological technologist

The United States Department of Labor defines radiological technologists and technicians as trained professional who perform diagnostic imaging examinations like x rays, computed tomography, magnetic resonance imaging, and mammography (USDL, 2010 – 2011).

The researcher defines radiological technologist operationally as any health professional, male or female trained in performing different X-Ray and imaging diagnostic procedures and working currently in any governmental hospital in the GS..

1.8 Lay out of the study

This study consists mainly from five chapters: introduction, conceptual framework and literature review, methodology, results and discussion, conclusion and recommendations.

The first chapter browsed general introduction to the study, where a brief background regarding the subject of the study was provided. The researcher illustrated the research problem, justification for conducting the study, objectives of the study, questions of the study, definition of terms and context of the study.

The second chapter included two parts: the first part is conceptual framework where the researcher provided a schematic diagram of the conceptual framework of the study. The second part is the literature review related to the study topic and variables. In-depth detailed theoretical inquiry including previous studies were presented.

The third chapter described methodology including study design, population, sample, instrument, pilot study including validity and reliability of study instrument, ethical considerations and statistical analysis.

In the fourth chapter, the study results and discussion were presented. The researcher treated the results in form of tables that make it easy for the reader to understand and make comments. The results were discussed in respect to available published previous studies that directly related to the topic of this study and its objectives.

Finally, in the fifth chapter, the researcher presented conclusion and recommendations in the light of the study results.

Chapter Two

Conceptual framework and literature review

2.1 Conceptual framework

Based on the review of available literature, the researcher designed the conceptual framework. Conceptual framework is used to guide and direct the research process and to make research findings more meaningful. The diagram below illustrates that the occurrence of MSDs among RTs in relation to different socio-demographic factors (gender, age and years of experience), risk factors that may lead to MSDs. Type of pain and its

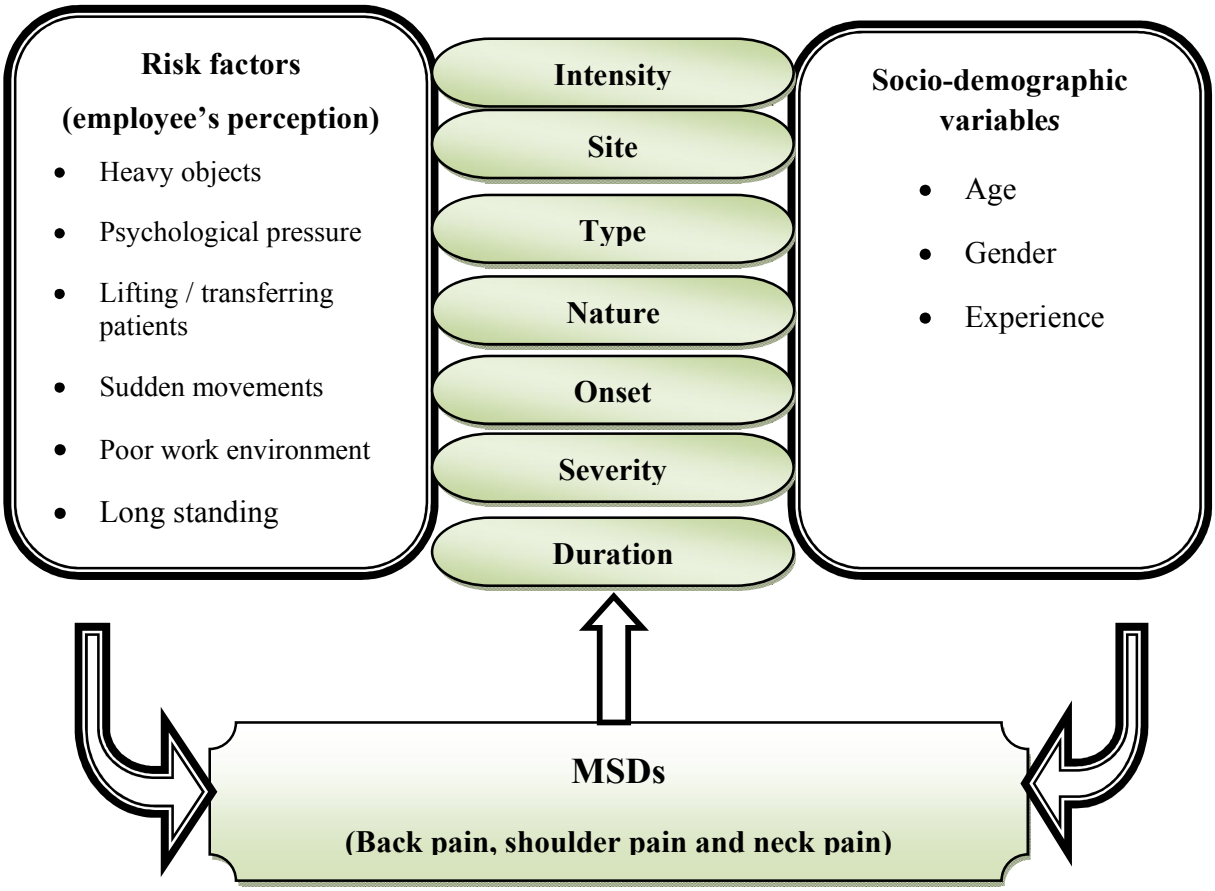


Figure (2.1): Conceptual framework diagram

Literature review

2.2 Introduction

MSDs constitute a major public health problem in the industrialized countries. MSDs cause individual suffering, trouble in daily living, and considerable economic and societal consequences due to short and long-term work disability and productivity losses (Buckle, 2005). Low back pain (LBP), neck pain and shoulder disorders are common among working populations and are the main reasons for work-related consultations in general practice (Taimela, *et al*. 2007). In general, population studies in different countries, the lifetime prevalence of back disorders has varied between 30% and 84% and that of neck disorders has been about 70% (Riihimaki, 2005). Another study showed the lifetime prevalence of back pain was as high as 76% among women and 77% among men, and that of neck pain 68% among women and 54% among men. A recent survey based on self-reported data from European workers claimed that about 33% of Finnish workers reported work-related pain in their neck, arms and shoulders. In the descending order of pain reporting, the Finnish workers ranked as the eighth of all EU member states (Bevan, *et al*. 2009).

MSDs are the most significant health problems faced the workforce today, with a percentage of 35%; fatigue and depression are increased among members of workforce leading to burnout and occupational exhaustion syndrome (European Foundation for the Improvement of Living and Working Condition, 2006).

2.3 Musculoskeletal system

2.3.1 Definition

Musculoskeletal system is the system of muscles, tendons, and ligaments, bones, joints, and associated tissue that move the body and maintain its form (www.Answer.Com).

2.3.2 Anatomical review of musculoskeletal system

A musculoskeletal system (also known as the locomotor system) is an organ system that gives animals (including humans) the ability to move using the muscular and skeletal systems. The musculoskeletal system provides form, support, stability, and movement to the body. It is made up of the body's bones (the skeleton), muscles, cartilage, tendons, ligaments, joints, and other connective tissue that supports and binds tissues and organs together. The musculoskeletal system's primary functions include supporting the body, allowing motion, and protecting vital organs. The skeletal portion of the system serves as the main storage system for calcium and phosphorus and contains critical components of the hematopoietic system. This system describes how bones are connected to other bones and muscle fibers via connective tissue such as tendons and ligaments. To allow motion, different bones are connected by joints. Cartilage prevents the bone ends from rubbing directly on to each other. Muscles contract (bunch up) to move the bone attached at the joint. There are, however, diseases and disorders that may adversely affect the function and overall effectiveness of the system. These diseases can be difficult to diagnose due to the close relation of the musculoskeletal system to other internal systems. The musculoskeletal

system refers to the system having its muscles attached to an internal skeletal system and is necessary for humans to move to a more favorable position (Kahn and Scott, 2008).

2.4 Work-related musculoskeletal disorders (WRMSDs)

Canadian Center for Occupational Health and Safety (CCOHS) defined WRMSDs as groups of painful disorders of muscle, tendons and nerves. Work activities, which are frequent and repetitive, or activities with awkward postures cause some disorders that may cause pain during work or at rest. Almost all types of work require the use of the arms and hands. Therefore, most WRMSDs affect the hands, wrists, elbows, neck and shoulders. Work using the legs can lead to WRMSDs of legs, hips, ankles and feet. Some back problems also result from repetitive activities (CCOHS, 2005).

2.5 Musculoskeletal disorders

2.5.1 Definition of MSDs

MSDs refer to a condition that can affect the body's muscles, joints, tendons, ligaments, and nerves. Most MSDs develop over time and caused either by the work itself or by the employee's working environment. They also result from fractures in accidents. Typically, MSDs affect the back, neck, shoulders and upper limbs; less often, they affect the lower limbs (OSHA, 2010).

2.5.2 Symptoms of MSDs

The symptoms of MSDs occur in the upper limbs, back, neck and hips, the damage involved the tendons, muscles, joints, blood vessels and peripheral nerves (Hales and Bertsche, 1992). The symptoms include; pain, localized and /or general mainly in the neck, lower back, shoulders and arms, numbness, mainly in the hands, wrists and elbows, tingling, itching, burning sensation, weakness in the arms, swelling, particularly in the wrists and hands, loss of functions and a change in skin color in the hand or fingers (Wihlidal and Bertsche, 1997). Symptoms vary from person to person but the common symptoms are : pain, fatigue and sleep disturbances (www.medicinenet.com, 2009).

2.5.3 Diagnosis of MSDs

MSDs Diagnosis usually is based on the symptoms and on the results of physical examination. Laboratory tests, imaging tests, or other diagnostic procedures are sometimes necessary to confirm a diagnosis.

2.5.3.1 Laboratory tests

Laboratory tests are also often useful to help monitor the progress of treatment. For example, the ESR can be particularly useful in helping to monitor the progress of treatment in rheumatoid arthritis or polymyalgia rheumatic. The level of creatine kinase (a normal muscle enzyme that leaks out and is released into the bloodstream when muscle is damaged) may also be tested. Levels of creatine kinase are increased when there is widespread ongoing destruction of muscle. In rheumatoid arthritis, a blood test to identify rheumatoid factor or anti-cyclic citrullinated peptide (anti-CCP) antibody is helpful in

making the diagnosis. In systemic lupus erythematosus (lupus), a blood test to identify autoimmune antibodies (antinuclear antibodies) is helpful in making the diagnosis (Michael, 2006).

2.5.3.2 X-rays

X-rays are most valuable for detecting abnormalities in bone and are taken to evaluate painful, deformed, or suspected abnormal areas of bone. Often, x-rays can help to diagnose fractures, tumors, injuries, infections, and deformities (such as congenital hip dysplasia). In addition, sometimes x-rays are helpful in showing changes that confirm a person has a certain kind of arthritis (for example, rheumatoid arthritis or osteoarthritis). X-rays do not show soft tissues such as muscles, bursae, ligaments, tendons, or nerves. To help determine whether the joint has been damaged by injury (Michael, 2006).

2.5.3.3 Computed Tomography (CT)

Computed tomography (CT) give much more detail than conventional x-rays and may be performed to determine the extent and exact location of damage. These tests can also be used to detect fractures that are not visible on x-rays. CT best images the bone (Michael, 2006).

2.5.3.4 Magnetic Resonance Imaging (MRI)

MRI is valuable for imaging muscles, ligaments, and tendons. MRI can be used if the cause of pain is thought to be a severe soft-tissue problem (for example, rupture of a major ligament or tendon or damage to important structures inside the knee join (Michael, 2006).

2.5.4 Causes of MSDs

The causes of MSDs are varied from one person to another; muscle tissue can be damage with the wear and tear of daily activities. Trauma to an area, auto accidents, falls, fractures, sprains, dislocations can also cause musculoskeletal pain. Prolonged immobilization, repetitive movements, overuse and postural strain also caused MSDs .Abnormal postures and positions may result in chronic nerve compression, or may shorten muscle, if the muscle crosses over a nerve, compression may occur. These postures may also contribute to muscle imbalance (Novak, 2004). Poor equipment design such as keyboard/screen height and position, equipment maneuverability, ill adjusted or non adjustable chairs and examination couches, poor posture due to the type of work performed especially with the shoulder in sustained abduction and the spine in an unnatural alignment, sustained pressure and force often used to optimize imaging, repetitive movements particularly when performing sessions of similar examinations, awkward scanning techniques especially when performing endocavity, cardiac, musculoskeletal and vascular examinations, assisting with patient movement, and body habits and gender, inadequate work breaks with insufficient recovery time and overall job stress may cause MSDs (Wihlidal, *et al*. 1997). Also, musculoskeletal pain can be caused by damage to bones, joints, muscles, tendons, ligaments, or nerves. Injuries are the most common cause. If no injury has occurred or if pain persists for more than a few days, then another cause is often responsible .Bone pain is usually deep, penetrating, or dull. It commonly results from injury. Other less common causes of bone pain include bone infection (osteomyelitis) and tumors. Muscle pain is often less intense than that of bone pain but can be very unpleasant. For example, a muscle spasm or cramp (a sustained painful muscle contraction) in the calf is an intense pain that is commonly called a charleyhorse. Pain can occur when a muscle is affected by an injury, an autoimmune reaction (for example, polymyositis or dermatomyositis),

and loss of blood flow to the muscle, infection, or invasion by a tumor. Tendon and ligament pain is often less intense than bone pain. It is often worse when the affected tendon or ligament is stretched or moved. Common causes of tendon pain include tendinitis, tenosynovitis, epicondylitis, and tendon injuries. Common causes of ligament pain include injuries (sprains).Some musculoskeletal disorders cause pain by compressing nerves. These conditions include the "tunnel syndromes" (for example, carpal tunnel syndrome, cubital tunnel syndrome, and tarsal tunnel syndrome). The pain tends to radiate along the path supplied by the nerve and may be burning. Sometimes, pain that seems to be musculoskeletal is actually caused by a disorder in another organ system. For instance, shoulder pain may be caused by a disorder affecting the spleen or gallbladder. Back pain may be caused by an abdominal aortic aneurysm. Arm pain may be caused by a heart attack (myocardial infarction). Additionally, sometimes pain that seems to be coming from one part of the musculoskeletal system actually comes from another part. For instance, knee pain in an adolescent may be caused by a disorder of the hip called slipped capital femoral epiphysis (Jacewicz, 2006).

2.5.5 Risk factors for developing MSDs

MSDs are the single largest category of work-related illness, representing a third or more of all registered occupational diseases in the Nordic countries, the United States and Japan, it has been estimated that about 40% of all upper limb disorders in the total US employed population were attributable to occupational exposures (Punnett and Wegman, 2004). In global terms, 37% of LBP appear to be caused by occupation, and work-related LBP has been estimated to be responsible for 818,000 disability-adjusted life years being lost annually (Punnett, *et al*. 2005). Accordingly, risk factors related to work have been extensively studied. The WHO has defined 'Work-related musculoskeletal diseases' as diseases that can be partly caused by adverse working conditions, or which may be

aggravated, accelerated or exacerbated by work place exposures, or such that may impair working capacity (WHO, 1985).

Epidemiologic evidence has accumulated that both physical and psychosocial factor at work and individual factors play a role in the development of MSDs (Bongers, *et al*. 2006). Psychosocial risk factors for work-related MSDs can be categorized into those that are specific to the workplace (low social support at work, job satisfaction, low skill discretion, low job control) and those that are individual psychosocial or psychological characteristics, such as depression, anxiety and mental stress (Bernard, 1997).

2.5.5.1 Physical workload

Several studies were conducted to determine the risk factors of MSDs. In a prospective cohort study with one-year follow up among physiotherapists to determine the effects of specific risk factors, the results showed that patients transfer, patients repositioning, bent or twisted postures, joint mobilization, soft tissue work and job strain, all of these factors increased the risk for WRMSDs (Campo, 2008). Another study conducted in China to investigate the association between MSDs and work-related risk factors in the medical staff in a single radiology department, it was found that pain was significantly higher among workers performing tasks with repetitive movements, physical activities such as bending, twisting, or reaching. Upper limb pain was more common among X–ray technologists who repeatedly handle radiographic cassettes, sitting for prolonged periods and wearing a lead apron weighing 4-6 Kg also a significant risk factor for developing MSDs, and in particular back pain. Because workload was increased low back pain in technologists according to

study results, it was found that time off was a protective factor for MSDs, and it may be significantly lower the risk of lower limb pain (Hung, *et al*. 2009). A recent review (Bakker, *et al*. 2009) considered cohort studies only from years 1997-2007. The reviews indicate that the evidence is strong for manual materials handling, bending and twisting postures at work, and whole body vibration as being risk factors for LBP. A study conducted by Morken, *et al*. (2007) to analyze WRMSDs and risk factors in Norway's offshore petroleum industry from 1992-2003, It's result showed that high physical workload reported the highest cause of WRMSDs with a percentage of 38%, followed by repetitive work 26%, walking on hard surfaces, climbing ladders was reported as the cause of 10% of the causes.

In a field study, Kumar, *et al*. (2003) investigated the biomechanical loads placed on x-ray technologists during a select number of tasks. The tasks included

- Wearing a lead apron
- Loading a small x-ray cassette into a multiloader
- Loading a larger cassette into a multiloader
- Pushing and pulling an x-ray tube
- Pushing a mobile x-ray unit on the floor
- Pulling a mobile x-ray unit on the floor
- Pushing a patient stretcher in a hallway
- Pushing a wheelchair with a patient in a hallway
- Repositioning a patient horizontally in bed

- Repositioning a patient on side in bed
- Repositioning a patient to an upright seated position
- Repositioning a cassette under a patient
- Slider board transfer of a patient
- Spine board transfer of a patient
- Pulling the spine board
- Lifting a patient from a wheelchair.

A study of seven X-ray technologists sought to determine the biomechanical loads experienced by X-ray technologists performing their routine daily tasks. The participants were recorded on videotape to document joint angles, while working. This data was used along with participant weight, height and input into the static strength model for calculation of the lumbosacral load. The investigators concluded that the X-ray technologists' work was found to be biomechanically demanding with tasks such as repositioning patients horizontally and lifting a patient from a wheelchair resulting in lumbosacral compression loads of 7,936N and 8,335N respectively, which exceeded the maximum permissible lumbosacral compression limit set by National Institute for Occupational Safety and Health (NIOSH, 1997). Questionnaire results indicated that 83% of the female sample had back problems. Of note is the finding that 67% of all the technologists "mostly liked" their jobs and 17% "always liked" their jobs. This suggests a high degree of job satisfaction among these subjects. Significant joint torques were observed during various activities, such as repositioning and transferring patients and repositioning cassettes under patients. Awkward

joint angles were observed, particularly with maneuvering the x-ray tubes which is usually repeated many times per day.

Punnett and Wegman, (2004), reported that rapid work pace, repetitive movement, forceful exertions, non-neutral body postures, insufficient recovery time, and vibrations are physical ergonomic features of work that considered as risk factors for MSDs.

In the article published on Scandinavian Journal on 2002, studied the relationship between a combination of demanding work schedule characteristics and reported MSDs of the neck, shoulders, and back among 1163 nurses randomly selected from the list of actively licensed nurses in two states in USA. In this cross sectional study the results showed that four of the nine work schedule characteristics (working full time,>8 hours/day, 2-4 weekends/month, and other than day shift) were significantly related to musculoskeletal disorders in one or more body sites (Lipscomb, *et al*. 2002).

The main factors that contribute to musculoskeletal injuries in sonographers are poor equipment design, poor postures due to the type of work performed, sustained pressure and force, repetitive movements, awkward scanning techniques, assisting with patient movement, body habits, gender and overall job stress (Wihlidal and Bertsche, 1997).Various work related factors have been established as predisposing to pain disorders. In dentists , over strained and awkward back postures can lead to back pain, repetitive actions predispose to neck and shoulders disorders, and psychological stressors can lead to back, neck, and shoulders complaint (Szymanska, 2002). A recent Canadian study found that all tasks performed by RTs were stressful, either for the lower back or for upper

extremities. The most stressful tasks for back were manually lifting patients from wheel chairs, transferring patients using spine borders and repositioning cassettes under patients. The most stressful tasks for the upper extremities included carrying cassettes in one hand and bending, unloading and repositioning cassettes (Chavez, 2005).

2.5.5.2 Psychosocial factors at work

Many psychosocial factors at work have been found to be associated with the occurrence of MSDs, such as rapid work pace, monotonous work, low job satisfaction, low workplace social support, high job demands, low job control ,work stress, non-work-related stress, and high and low skill discretion (Bongers, *et al*. 2006). Another study found that 83.4% of medical students experienced musculoskeletal symptoms, which were attributed to stress related work overload (Egwu, *et al*. 2006). Poor social relationships at work and poor job control predicted the increase of pain and clinical findings in the neck and upper limbs, low back, and lower limbs in a 10-year follow-up of industrial workers (Leino and Hanninen, 1995). In a two-year prospective study among newly employed workers, those who reported low job satisfaction, low social support and monotonous work had an increased risk of new-onset widespread pain (Harkness, *et al*. 2004). Result from a study have shown that radiographers in South-East Nigeria experience work-related biomechanical stress symptoms in almost all anatomical regions examined. Upper back musculoskeletal symptoms of pain were the most prevalent 37.5% (Egwu, *et al*., 2006). Macfarlane, *et al*. (2009) evaluated the evidence on associations between psychosocial factors at work and MSDs. With regard to back pain, the conclusions were the most consistent for an association with high job demands, low job satisfaction and low work support. For

neck/shoulder pain, consistency in conclusions was found both regarding high work demands and for low job demands.

2.5.5.3 Health-lifestyle related factors

Finnish researchers have studied MSP among adolescents, they found that a high physical activity level, long sitting time, short sleeping time, and smoking were associated with MSP in both boys and girls though the associations were stronger in girls In addition, MSP was associated with overweight in girls (Paananen, *et al*., 2010). Shiri and others studied recently the relationships of overweight, obesity and smoking with LBP; overweight and obesity increased the prevalence of LBP. The findings pointed to stronger associations in women than in men. Both current and former smokers were observed to have a higher prevalence and incidence of LBP than never smokers .Male smokers were at a higher risk of LBP than female smokers (Shiri, *et al*. 2010a, and b). Kauppila, (2009) found that smoking and high serum cholesterol levels were most consistently associated with disc degeneration and LBP.

2.5.5.4 Individual factors

Non-workplace factors, which contribute to work-related MSDs possibly influencing individual responses to workplace exposures, are considered as individual factors. Among these, gender, age, education, marital status, weight, height, overweight/obesity, smoking, exercise or sports, other hobbies, drug use, personality and various co-morbidities. The likelihood of developing MSDs, gradually increase with age. Over half of the older adults

in the US report chronic joint symptoms and the number of elders with arthritis is expected to double in the next 25 years (Leveille, 2005).Women tend to report more MSDs than men. The gender difference seems to be more distinct for neck and upper limb disorders, Strazdins and Bammer (2004) examined why employed women are much more likely than men to experience upper body disorders. The gender differences were explained by risk factors at work (repetitive work, poor ergonomic equipment) and at home (less opportunity to relax and exercise outside of work). Another study reported that genetic factors do not play an important role in the liability to neck pain in individuals 70 years of age or older (Hartvigsen, *et al*., 2005).

2.6 Epidemiology of MSDs

MSDs are among the most common of human afflictions, they affect all age groups and frequently cause disability, impairments, and handicaps (www.Answer.com). According to the study carried out in the US, MSDs represent a third or more of all registered occupational diseases, and cause more work absenteeism or disability in US, Canada, Finland, Sweden, and England (Punnet and Wegman, 2004). Also in the US, musculoskeletal complaints account for between approximately 15% and 23% of visits to family practice physicians (Chao, *et al*. 2004). A Prospective cohort study with one year follow up to understand the work-related MSDs in physical therapists in US, showed that 57.5% reported a work related pain or discomfort in different body regions (Campo, *et al*. 2008). In Europe, many workers in a wide range of jobs develop work related upper limb

disorders and they are the most common form of occupational diseases accounting for over 45%of all occupational diseases (OSHA, 2007). Another study carried out in Italy among109 X-ray technologists' students, found that a 37% prevalence for MSDs at anybody site, LBP was the most commonly reported symptom 27%, followed by neck pain 16% and shoulder pain 11% (Lorusso, *et al*. 2010). The prevalence of MSDs among X-ray technologists working at thirteen hospitals in South Italy was 76%, also LBP was the dominant symptom in 59.6% of the participants and the lowest one was hands/wrists (Lorusso, *et al*. 2007).

Bos, *et al*. (2007) conducted a cross-sectional survey of 3,169 nurses and x-ray technicians in the Netherlands to estimate prevalence rates of musculoskeletal complaints and determine the relation between physical and psychosocial work-related risk factors. This study found an overall prevalence rate of low back complaints within the past 12 months of 76% for the entire sample. The 12- month prevalence of low back complaints in x-ray technicians was 75.1%, which was similar to the rate for operation-room nurses 76.6%, non-specialized nurses 76.2%, and intensive-care nurses 74.9%. The researcher concluded that X-ray technologists as a professional group have comparable prevalence rates to nurses. The work-related factor perceived by X-ray technicians as being predictive for low back complaints was dynamic load involved in a task.

Another study conducted in Canada to determine morbidity among X-ray technologists aging from 20-53 and physically active, found that the prevalence rate of musculoskeletal pain among them was high, 83% of the participants have back pain,39% of females have neck pain, 28% have shoulder pain and 50%suffer from upper extremities pain (Kumar, *et*

al. 2004). In main land China, MSDs represents an important issue, where the prevalence of MSD_s among white –collar workers and professionals in Beijing was 92.2%, with neck pain 72.2%, shoulder and LBP 59.9% each (Smith, *et al*. 2006). A study conducted in Germany to determine the prevalence and symptoms predicting factors at visual display terminal workstation showed that 1-year prevalence of MSDs of upper extremities, neck and shoulders was 55% and 38% respectively (Klussman, *et al*. 2008).

Regionally, few studies were conducted to study MSDs. In a study conducted in Saudi Arabia to find out the prevalence and distribution of musculoskeletal symptoms among dentists, the study results showed that 82.9% of the responding dentists had one or more symptoms of pain or discomfort in the musculoskeletal system, 59% had pain in different parts of the locomotor system where the most severe symptom was in neck 67.9% followed by LBP 52.1% and the symptoms are most pronounced among female dentists (Abdul-Jabaar, 2008). A study conducted in Sudan among office workers and the one-year prevalence of compliant of arm, neck and shoulders showed that (250) 53% of the respondents could be classified as mild cases. The highest incidences were found for neck 64% and shoulder symptoms 41% (El-Tayeb, *et al*. 2008). The prevalence and risk factors associated with LBP among health professionals in Kuwait hospitals was studied and the result showed that lifetime prevalence of LBP was 70.9% and the point prevalence was 21.5% (Michael, *et al*. 2008). A study conducted locally in Israel revealed that $WRMSD_s$ among physical therapists was 83%; the highest prevalence in the lower back 80%. Rehabilitation treatment was associated with an increased risk of LBP and shoulder pain (Rozenfeld, *et al*. 2009). Also among the laboratory technicians working at

governmental hospitals in Gaza governorates, the prevalence of MSP was 68.7%, and 21% of the subjects suffered from back pain, followed by lower extremities 4.6%, neck pain 5.7% and the shoulder pain was 4% (El-Astal, 2010).

In 2006, Jouda performed a study about occupational hazards among governmental hospitals in GS. The study showed that slightly less than half of the study population 45.9% complained of myalgia and arthalgia .The prevalence of LBP found to be slightly higher among operating room nurses than other health professionals, it was 70.6% as reported in recently study conducted in Gaza governorates (Al Nawajha, 2011).

2.7 Management of MSDs

Different types of manual therapy or mobilization can be used to treat people with spinal alignment problems. For acute musculoskeletal pain, these techniques have been shown to speed recovery. In patients with musculoskeletal disorders such as fibromyalgia, medications to increase the body's level of serotonin and norepinephrine (neurotransmitters that modulate sleep, pain, and immune system function) are prescribed in low doses. Some of the medicines used to aid sleep include Ambien, Klonopin, and Desyrel. Other treatments may include; injections with anesthetic or anti-inflammatory medications in or around the painful sites, exercise that includes muscle strengthening and stretching, physical or occupational therapy, Acupuncture or acupressure, relaxation/biofeedback techniques, osteopathic manipulation (a whole system of evaluation and treatment designed to achieve and maintain health by restoring normal function to the body), chiropractic care and therapeutic massage (www.Medicinenet.com, 2011). Participatory

ergonomics has been seen as one promising approach to rehabilitation of workers suffering from MSDs. Loisel, *et al*. (2001) has described a program with four steps: First, the ergonomist meets the worker to collect data on personal characteristics. Job descriptions are sought from both the worker and his/her supervisor. Secondly, a meeting is organized in the workplace with the worker and the supervisor to compare the job descriptions, make a list of the risk factors for back pain, and to identify work organization and job demands relevant to the back pain. Thirdly, the ergonomist visits the workplace to observe the work tasks performed by another worker. Finally, the participatory work group meets to identify improvements in the work tasks. Final acceptance of these solutions is the employer's responsibility.

2.8 Prevention of MSDs

Many work-related injuries are caused or aggravated by stressors such as heavy lifting, contact stress (repeated or constant contact between soft body tissue and a hard or sharp object, such as resting a wrist against the edge of a hard desk or repeated tasks using a hammering motion), vibration, repetitive motion, and awkward posture. Applying ergonomic principles designing furniture and tools to protect the body from injury at home and in the workplace can greatly reduce the risk of back injury and help maintain a healthy back. More companies and homebuilders are promoting ergonomically designed tools, products, workstations, and living space to reduce the risk of musculoskeletal injury and pain (NIAMS, 2010). Preventive measures should be taken to avoid Musculoskeletal injuries, therefore Gregory, put suggestions to improve work condition among sonographers such as educational supplement, using appropriate equipment design,

adjustable chairs and couches, vary workload and tasks, take frequent work breaks and introduce exercise routines such as stretching and fitness program (Gregory, 1998). In the study published in 2006 by Business journal, it recommended that the most important aspect of back injury prevention among RTs is employee training. Training programs that actively involve employees in the design and the implementation of ergonomic solutions will increase job satisfaction and compliance. The training program needs to be updated as changes occur. For example, if a department has no mechanical assistance devices, policies need to be changed when the equipment becomes available. Training should include proper lifting guidelines such as the following: Never transfer patients or lift when off balance, keep loads close to the body, never lift heavy loads alone, use mechanical assistance or lift teams and limit the number of lifts per day (Chavez, 2005).

Rocha, *et al*., (2005) reported that prevention of MSDs among call center operators requires an integrated approach including improved workstation design, thermal comfort environment, well-scheduled work-rest regime and realistic production goals. The risk of musculoskeletal symptoms and musculoskeletal disorders may be reduced by encouraging specific seated postures as reported by Marcus, *et al*., (2002). Training and education combined with the use of mechanical or other aids may be effective, which can be partly explained by a decrease in the frequency of manual lifting (Bos, *et al*. 2007).

2.9 Cost of MSDs

MSDs are the most common causes of sever long term pain and physical disability, in US musculoskeletal conditions cost approximately $850 billion per year, and accounting for

130 million patients visits to health care providers annually (Dougherty, 2009). Swedish insurance data showed that 18% of disability payments made for MSDs were spent on neck and shoulders problems. Thus, shoulder pain is widespread and imposes a considerable burden on the effected persons and society (Nygren, 1995). Employers pay over 30 billion dollars in worker compensation costs for MSDs each year. Direct costs associated with occupational back injuries of health care providers average 37,000 dollars. In addition, there are other indirect costs (Spray, 2009).

2.10 Sickness absence among workers

MSDs represent an important cause of morbidity and disability. Currently 40% of worldwide work-related health costs are attributed to MSDs. In Norway, MSDs have been the dominant cause of sickness certification by a doctor, whether measured by incidence, duration of single episodes or number of days of work lost. A study of sickness certification concluded that more than one third of the health problems causing sickness certification were potentially preventable. Many episodes of sickness absence have a multi factorial background and many are not, or only marginally, related to the work environment. At the occupational level, several factors influence sickness absence from MSDs, such as the physical and psychosocial environment, job title, and the absenteeism culture at and outside work. At the individual level, age, gender and diagnosis have been associated with sickness absence from MSDs (Morken, *et al.* 2003). According to Finnish statistics in 2007; MSDs were the most common reason for receiving sickness absence benefits accounting for 35%

of all absence periods. There were almost 126 000 incident sickness allowance periods due to MSDs in 2007. The resulting benefit expenditures were about 273 million euros making up 36% of all the benefits. With respect to disability pensions, 24% were due to MSDs. Both the numbers of sickness benefit days and disability pensions were more common in women (Haukka, 2010). In all 27 EU Member States, MSDs are the main cause of absence from work, and in some countries, 40% of the costs of workers' compensation are attributable to MSDs (Podniece, 2008). About 30.8% among physiotherapy professionals in GS have a sick leave due to LBP (Masoud, 2004).

2.11 MSDs among Radiological Technologists

There is a high prevalence of MSDs among healthcare professional. Recent studies showed that MSDs are a common problem among X-ray technologists. In a study conducted to determine the prevalence of musculoskeletal complaints among a group of (109) Italian X-ray technology students currently attending the 3-year X-ray technologist school at a large University in the Apulia region of Southern Italy. A questionnaire collected data concerning personal characteristics, physical exposure during training activities, and the presence of musculoskeletal symptoms in the neck, shoulders, low back, hand/wrist and legs. The Results showed that the prevalence of musculoskeletal complaints at any body site in the previous 12 months was 37%. LBP was the most commonly reported symptom 27%, followed by neck 16% and shoulder pain 11% (Lorusso, *et al*. 2010). A retrospective case-control study at the Istituti Ortopedici Rizzoli in Bologna in Italy investigated the risk

factors for LBP in hospital workers. Compared with a control group of hospital staff, the risks of low-back pain were significantly higher in nursing and health aides (OR= 21.67), in nurses (OR= 20.21), in therapists (OR= 16.36) and in X-ray technicians (OR= 13.64). The risk of occupational back injury was highest in the orthopedic wards, in the plaster-rooms, in the operating blocks and in the sterilization plants. Increased risk of back pain was strongly associated with specific manual handling. Non- occupational factors (cigarette smoking, previous trauma leading to hospital admission, and for women, number of children), showed only weak associations (Hedge, 2000).

A self-administered, modified Nordic Musculoskeletal Questionnaire was used to investigate the association between MSDs and work-related risk in a radiology department with 107 staff members, their practices, work descriptions, prolonged postures and movements, and body pain. The study found that the majority of respondents (77.3%) reported at least one episode of body pain during the previous year. Forty-four percent of respondents were able to have time off during work shifts, and 42.3% worked more than eight hours per shift. Pain in the neck or shoulder 61.9% was the most common complaint. There was a lower incidence of body pain for staff members who could arrange at least some time off during the work shift than for staff unable to do so (Hung, *et al*. 2009).

In a Canadian study in 2004 to determine morbidity among X-ray technologists, they were surveyed using structured questionnaire and face-to-face interviews for their personal, recreational, occupational and health variable. A random sample of 20 volunteer participants from two University hospitals was used. The responses were analyzed for magnitude, duration and frequency analysis of activities; and, severity, duration and

recurrence of morbidity. The X-ray technologists were a young group of professionals ranging from 20 to 53 years of age. Eighty-nine percent of the samples were physically active. Despite the young age and active life style, the X-ray technologists had significant and diverse musculoskeletal problems. 83% of the sample had backache, 39% of female sample had neck pain and 28% shoulder pain. The pain among the sample was aggravated by work activities and relieved by rest, massage, heat/ice and exercise. Majority of technologists suffered multiple episodes of pain. Fifty percent of the female sample suffered from upper extremity pain (Kumar, *et al*. 2004).

Bos, *et al*., (2007) conducted a cross-sectional survey of 3,169 nurses and x-ray technicians in the Netherlands to estimate prevalence rates of musculoskeletal complaints and determine the relation between physical and psychosocial work-related risk factors. This study found an overall prevalence rate of low back complaints within the past 12 months of 76% for the entire sample. The 12- month prevalence of low back complaints in X-ray technicians was 75.1%, which was similar to the rate for operation-room nurses 76.6%, non-specialized nurses 76.2%, and intensive-care nurses 74.9%. The researchers concluded that X-ray technologists as a professional group have comparable prevalence rates to nurses. The work-related factor perceived by X-ray technicians as being predictive for low back complaints was dynamic load involved in a task.

2.12 Summary

MSDs constitute a major health problem for many professions including health care professions. Consistent epidemiologic reports indicate that MSDs are major medical and economic problem. Pain and the associated disability is linked with a significant loss of productivity and substantial healthcare expenditures (Rollman & Lautenbacher, 2001).

There are many factors found to be as risk factors for the development of MSDs and subsequent pain and discomfort. Part of these factors is considered personal factors including gender, age and proper use of ergonomic approaches during work. Other factors are related to the workplace conditions including space, lighting, ventilation, procedures performed, type of work and the overall design of the work place environment. Psychological pressure also playing a role in developing pain and discomfort caused by work overload, crowd, direct contact with patients and their relatives and the perception of the dangers due to exposure to X-ray. MSDs affect high percentage of RTs from all ages including young age. Kumar, *et al*., (2004) reported that young age, active RTs had significant and diverse musculoskeletal problems. 83% of the sample had backache; pain was aggravated by work activities and relieved by rest and exercise. In order to alleviate this problem, modification of workplace environment should be considered and educational sessions / instructions regarding safety measures during work should be implemented.

Chapter Three

Methodology

This chapter covers issues related to methodologies used to answer the research questions. The chapter commences with study design, study population, study setting, and period of the study, sample size, sampling and method of the study. It presents construction of the questionnaire, piloting, ethical consideration and procedures, (data collection and data analysis). Furthermore, it illustrates the validity and reliability of the study instrument and selection criteria of the study.

3.1 Study design

The type of this study was descriptive, analytical, cross sectional. Descriptive study describes the investigated phenomena as it naturally occurs. Analytical because it assesses the relationship between the investigated phenomena and other factors. Cross sectional can provide a snapshot of the characteristics of the subjects under investigation at a particular point in time which may differ if another time has been chosen; it is relatively inexpensive and takes little time to conduct (Levin, 2006).

3.2 Study population

All RTs employed currently at all governmental hospitals in GS, who have technical responsibilities in radiology departments at the time of the study. The total number is 192 RTs. The researcher considered the population as the study sample for this study (census sample). The researcher distributed 177 questionnaires to all RTs. The total number of RTs

who agreed to participate in the study was 172 (136 males and 36 females), with response rate 97%. 15 RTs participated in the pilot study and were excluded from the actual study, 3 refused to participate in the study and two female RTs were pregnant.

Table (3.1): Distribution of study sample according to hospital

Hospital	Frequency
Al-Shifa medical complex	39
Nasser medical complex	24
European Gaza Hospital	19
Al-aqsa martyrs hospital	16
Kamal Odwan hospital	16
Al-Najjar hospital	13
Al-nasser pediatric hospital	10
Al-Rantisi pediatric hospital	10
Beit Hanoon hospital	9
Al-Emaratey maternity hospital	8
Al-Dora pediatric hospital	8
Total	**172**

3.3 Selection criteria

3.3.1 Inclusion criteria

All formally employed RTs (males and females) working in Gaza governmental hospitals and have technical responsibilities at the time of the study.

3.3.2 Exclusion criteria

- Pregnant RT.
- Have an experience less than 1 year.
- Anyone who has a congenital deformity, or trauma (not caused by work conditions) that led to musculoskeletal discomfort or pain.

3.4 Setting of the study

This study was carried out at all radiology departments in Gaza governmental hospitals including: Al-shifa hospital, European Gaza hospital, Al-aqsa Martyrs hospital, Crescent Alamaraty hospital, Kamal Adwan hospital, Aldora hospital, Abu Yousef Al Najjar hospital, Nasser medical complex, Beit Hanoun hospital, Alrantessi pediatric hospital and Alnasser pediatric hospital.

3.5 Period of the study

The study was conducted during the period from May 2011 to October 2011.

3.6 Ethical consideration

The researcher was committed to all ethical consideration required to conduct a research. An official letter of approval was obtained from Helsinki Committee (Palestinian ethical committee). In addition, an official letter of request was obtained from MOH Director General of hospitals to conduct the study in radiology departments at governmental hospitals. Furthermore, each participant in the study received an explanatory letter attached to the questionnaire about the purpose of the study, confidentiality of the information and the fact that the participation is optional.

3.7 Instrument of the study

After reviewing previous literature and studies, the researcher adopted a questionnaire for measuring musculoskeletal disorders / pain among health care professionals. These questionnaires were used by Al-Astal (2010) and Al-Nawajha (2011). The researcher implemented the necessary modifications to suit study participants.

The questionnaire consisted of 6 parts:

- The first part included personal and demographic data.

- The second part included characteristics of MSP.

- The third part included risk factors that may lead to development of MSDs (15 items)

- The fourth part included workplace conditions (8 items).

- The fifth part included medical advice to manage MSDs (5 items).

- The sixth part included suggestions to avoid MSDs (10 items).

3.8 Pilot study

To ensure validity and reliability of the study instrument, a pilot study was conducted on 15 participants (11 males and 4 females) before starting data collection. The piloting participants were excluded from the actual sample.

3.9 Validity and reliability

3.9.1 Validity

3.9.1.1 Face and content validity

The questionnaire was submitted to expert professionals for judgment and content adequacy. Their suggestions were considered in the development of the final questionnaire.

3.9.1.2 Internal consistency

The researcher calculated the correlation between each item and the domain it belongs to. The results are illustrated in table (3.2).

Table (3.2): Risk factors domain

Correlation between each item and total score of domain

Item No.	Correlation	Item No.	Correlation
1	.911	9	.513
2	.611	10	.834
3	.025	11	.802
4	.546	12	.133
5	.859	13	.646
6	.410	14	.790
7	.616	15	.771
8	.350		

Item number (3 and 12) have weak correlation with total score of the domain, so they were omitted from the final questionnaire.

Table (3.3): Work environment domain

Correlation between each item and total score of domain

Item No.	Correlation	Item No.	Correlation
1	.851	5	.866
2	.757	6	.312
3	.758	7	.608
4	.814	8	.442

Item number (6) have weak correlation, so it were omitted from the final questionnaire.

Table (3.4): Recommendations domain

Correlation between each item and total score of domain

Item No.	Correlation	Item No.	Correlation
1	.762	6	.472
2	.488	7	.785
3	.524	8	.800
4	.445	9	.412
5	.334	10	.580

Table (3.5): Medical advice domain

Correlation between each item and total score of domain

Item No.	Correlation
1	.925
2	.897
3	.990
4	.990
5	.925

Table (3.6): Correlation between each domain and total score of scale

Domain	Correlation
Risk factors	.686
Work environment	.521
Medical advice	.414
Recommendations	.773

3.9.2 Reliability

Reliability is an important character of an instrument. It concerned with how consistently the measurement technique measures the concept of interest. A measure is considered reliable if it gives the same results each time (Polit, 2004). To test reliability, the researcher used Cronbache alpha methods.

3.9.2.1 Cronbache alpha coefficient

The researcher calculated the reliability of the scale by using the equation of Cronbache alpha; where the value of alpha = 0.633.

Based on the results of testing validity and reliability, necessary modifications were implemented.

3.10 Data collection

The data was collected by the researcher. Instructions were given to study participants before filling the questionnaire. All the questionnaires were arranged and had a serial number.

3.11 Data entry and analysis

The researcher entered the data of the questionnaires using the Statistical Package for Social Sciences (SPSS version 13) with assistance of statistician and the steps was as follows: over viewing the filled questionnaires, coding of the questionnaires, data cleaning and designing data entry model.

Statistical procedures used included; frequency tables for the study variables means and percentage, cross tabulation and Chi square.

3.12 Limitations of the study

- The political situation, which led to the fact that some technologists with long years of experience left their work.
- Frequent electricity cut off.
- The researcher wanted to expand this study to include RTs in all Palestinian territories, but political and security constraints were obstacles.
- Lack of literature, books and scientific journals.

Chapter Four

Results and discussion

In this chapter, the researcher presented the results of the study, including sample characteristics. The results were discussed in comparison with literature review and related previous studies. To obtain the results, the researcher used SPSS program version 13. Statistical procedures were used including frequencies, mean, percentage and Chi square test.

4.1 Sample characteristics

The study sample consisted of 172 radiology technicians from all governmental hospitals in Gaza provinces. Of them, 136 were male and 36 female. Their age ranged between 23 – 59 years, with mean age 33.15. their experience ranged between 1 – 30 years, with mean 8.90 years. Sample characteristics are illustrated in table 4.1.

Table (4.1a): Sample characteristics

Demographic variable	Frequency	Percent %
Gender		
Male	136	79.1
Female	36	20.9
Total	172	100.0
Age		
30 years and less	93	54.1
31 – 40 years	45	26.6
41 – 50 years	25	14.5
51 – 59 years	9	5.2
Marital status		
Single	32	18.6
Married	140	81.4
Divorced / widow	0	0
Qualification		
Diploma	26	15.1
Bachelor	142	82.6
Post graduate	4	2.3
Monthly income		
less than 2000 IS	65	37.8
2000 – 3000 IS	90	52.3
more than 3000 IS	17	9.9

Table (4.1b): Sample characteristics

Demographic variable	Frequency	Percent %
Years of experience		
1 – 7 years	100	58.1
8 – 14 years	38	22.1
15 – 21 years	21	12.2
22 – 30 years	13	7.6
Total	172	100.0
Number of X-Ray procedures / day		
1 – 15	59	34.3
16 – 30	87	50.6
31 – 45	22	12.8
46 – 60	4	2.3
Total	172	100.0

4.2 Results of the study

4.2.1 Prevalence of musculoskeletal disorders

The researcher used frequency calculations and percentage to find out the prevalence of MSDs among study participants. The results were illustrated below.

Table (4.2): Prevalence of MSDs among study participants (N = 172)

	Male		Female		Total	
Presence of MSDs	Freq.	% within gender	Freq.	% within gender	Freq.	% within total
No	39	28.7	3	8.3	42	24.4
Yes	97	71.3	33	91.7	130	75.6
Total	136	100.0	36	100.0	172	100.0

The results showed that the majority of RTs 130 (75.6%) complained of MSDs, while 42 (24.4%) did not have MSDs. This result is higher than the results of El-Astal (2010) which showed that 68.7% of laboratory technicians were suffering of MSDs. Also, the results of Maumet, *et al.,* (2005) showed that the prevalence of MSP due to MSDs ranged between 20.6% and 52.0%, the results of Jouda (2006) reported that 45.9% of participants complained of MSP, the results of Lorusso *et al*. (2007) showed that 67.0% of X-Ray technologists complain of MSD at any site and the results of Lorusso *et al*. (2010) showed that 37.0% of X-Ray technology students suffered from MSDs, while the results of the current study were consistent with Maul, *et al*. (2003) results which showed that 73% - 76% of nurses were complaining of pain due to MSDs and the results of Hung, *et al*. (2009) showed that 77.3% of medical staff in radiology department reported at least one episode of pain during the last year.

In contrast, the study results were lower than the results of Salik and Özcan, (2004) where 85% of the Turkish physiotherapists reported that they had suffered from discomfort as a consequence of MSDs. The researcher assumed that the differences in prevalence of MSDs between different occupations could be related to differences in tasks performed during work as RTs spend most of the time standing doing different X-Ray procedures and their movements is restricted in a narrow area, added to that the high number of X-Ray procedures performed each day, which provoke strain on their musculoskeletal system and may lead to MSP.

4.2.2. Pain intensity and gender

Table (4.3): Pain intensity and gender

	Male		**Female**		**Total**	
Pain intensity	Freq.	% within gender	Freq.	% within gender	Freq.	% within total
Mild	11	11.3	3	9.1	14	10.7
Moderate	58	59.7	21	63.6	79	60.7
Severe	23	23.8	7	21.2	30	23.2
Very severe	5	5.2	2	6.1	7	5.4
Total	97	100.0	33	100.0	130	100.0
Chi square = 6.703				***P* value = 0.152**		

From table 4.2 and 4.3, the results showed that seventy one point three percent of male RTs and 91.7% of female RTs suffered from MSDs. This result indicated that the prevalence of MSDs are higher among female RTs compared to male RTs. Among those who complain of MSDs, 11.3% of male RTs have mild pain, 59.7% have moderate pain, 23.8% have severe pain and 5.2% have very severe pain. On the other hand, 9.1% of female RTs have mild pain, 63.6% have moderate pain, 21.2% have severe pain and 6.1% have very severe pain. Generally, this result show that 60.7% of RTs complain of moderate MSP and 28.6% complain of severe and very severe MSP.

In general, the differences in pain intensity between male and female RTs were not statistically significant as chi square was 6.703 and *P* value = 0.152.

This result agreed with the results of Lorusso *et al*. (2010) which showed that there were no significant differences in MSP related to gender. The study conducted by Strazdins and Bammer (2004) showed that employed women tend to report more MSDs than men and they revealed that to risk factors at work and less opportunities to relax at home. Also, the results of Wijnhoven, *et al.,* (2006) showed that 45% of women and 39% of men complain of MSP, the results of Jouda (2006) showed that female workers were complaining of MSP three times more than male, the findings of Rollman and Lautenbacher, (2001) suggest that musculoskeletal pain complaints are more common among women than men, the results of Bergman (2001) showed that chronic pain was associated with female sex and the results of Salaffi *et al.*, (2005) showed that musculoskeletal conditions were significantly higher among women than men.

In the opinion of the researcher, the higher complain of female compared to male RTs could be related to the anatomical structure of females, as they are weaker and have less muscles and their tolerance of hard work is less than males. Also, females have more duties and overloaded at home.

4.2.3 Site of MSP

Table (4.4): Site of MSP (n = 130)

Site of pain	Frequency	Percent %
Back only	41	31.5
Neck only	9	6.9
Shoulders only	4	3.1
Back + neck	25	19.2
Back + shoulders	10	7.7
Neck + shoulders	19	14.6
Back + neck + shoulders	22	17.0
Total	**130**	**100.0**

Table 4.4 show that pain in back only was the major site among those who have MSD and it accounts for 31.5%, followed by back and neck 19.2%, back, neck and shoulders 17.0% and neck and shoulders 14.6%. This result agree with El-Astal (2010) results which showed that back pain was the dominant site of MSP among study participants and it constitutes for 21.1% among those who complain of MSP and the results of Morken, *et al*., (2007) which showed that back disorders account for 20% of all WRMSDs and the results of Lorusso *et al*., (2010) which showed that LBP was the most frequently reported symptom 27.0%

followed by neck 16.0% and Lorusso *et al*., (2007) showed that LBP was the highest and it accounts for 59.6% of complaints of MSP. The results of Al Nawajha (2011) showed that 70.6% of operating room nurses were complaining of LBP and the results of Masoud (2004) showed that 56% of physiotherapists were complaining of LBP. Other studies reported a higher prevalence of work-related back pain, including Nyland and Grimmer (2003) which reported that back pain was 69% among study participants, Smith *et al*., (2004) showed that low back pain was the highest 56.7% and Rugelj (2003) showed that back pain affects 73.7% of physiotherapists, the results of Lorusso *et al*., (2007) showed that LBP prevalence rates have varied widely among different investigations conducted in Italy, ranging from 33% to 86%, the results of Kumar *et al*., (2004) showed that 83% of X-Ray technologists had backache, 39% of the female technologists had neck pain, 28% shoulder pain and 50% suffered from upper extremity pain and the results of Bos *et al*., (2007) showed that prevalence rates of musculoskeletal complaints were high among all groups (nonspecialized nurses, ICU nurses, operating room nurses and X-Ray technologists): low back 76%, neck-shoulder 60%. On contrast, the results of Hung, *et al*. (2009) showed that pain in the neck or shoulder 61.9% was the most common complaint, followed by lower back 47.4%. The results of this study and most of previous studies indicated that back was the major site for MSDs. This could be attributed to anatomical reasons as spine is located in the back. This assumption is supported by Patel and Ogle (2007) as they mentioned that the spine is a complex interconnecting network of nerves, joints, muscles, tendons and ligaments, and all are capable of producing pain. Also, poor

use of body mechanics, standing for long periods during work and lifting or transferring patients and heavy objects could contribute to back pain.

4.2.4 Type of musculoskeletal pain (MSP)

Table (4.5): Type of MSP (n = 130)

Type of pain	Frequency	Percent %
Tingling only	4	3.08
Burning only	8	6.15
Stabbing only	2	1.53
Spasm only	53	40.76
Numbness only	1	0.76
Tingling + spasm	13	10.0
Burning + spasm	9	6.93
Stabbing + spasm	12	9.24
Spasm + numbness	8	6.15
Tingling + stabbing + spasm	8	6.15
Tingling + spasm + numbness	5	3.84
Stabbing + spasm + numbness	3	2.30
Tingling + burning + stabbing + spasm + numbness	4	3.08
Total	**130**	**100.0**

Table 4.5 show that spasm was the major type of MSP and it accounts for 40.76% of complains, followed by tingling and spasm together 10.0% and stabbing and spasm together 9.24%. This result is consistent with other studies which revealed that spasm was

the major complaint among 25.7% of OR nurses (Al Nawajha, 2011), 61% among lab. technicians (El-Astal, 2010) and 69.6% among administrative and academic staff (El Keshawi, 2008). This result could be attributed to the assumption that sitting or standing in one position for long time during work could the cause of muscular spasm. This result emphasize the recommendation that health care providers who are working in relatively closed areas and narrow spaces to move frequently and not to stand still in one place for long time.

4.2.5 MSP and age

Table (4.5a): Distribution of pain intensity according to age (n = 172)

Age in years	**30 and less (n = 93)**		**31 – 40 (n = 45)**		**41 – 50 (n = 25)**		**51 – 59 (n = 9)**		**Total**	
Pain intensity	Freq.	% within age	Freq.	% within age	Freq.	% within age	Freq.	% within age	Freq.	% within total
No pain	18	19.4	15	33.3	5	20.0	4	44.4	42	24.41
Mild	7	7.5	2	4.4	4	16.0	1	11.1	14	8.13
Moderate	48	51.6	19	42.2	9	36.0	3	33.3	79	45.93
Severe	15	16.1	9	20.0	5	20.0	1	11.1	30	17.44
Very severe	5	5.4	0	0	2	8.0	0	0	7	4.06
Total	93	100.0	45	100.0	25	100.0	9	100.0	172	100.0
Chi square = 12.646					***P* value = 0.395**					

Table (4.5b): Distribution of MSP according to age (n = 130)

Age in years	30 and less (n = 93)		31 – 40 (n = 45)		41 – 50 (n = 25)		51 – 59 (n = 9)	
Presence of pain	Freq.	% within total	Freq.	% within total	Freq.	% within total	Freq.	% within total
No pain	18	10.5	15	8.7	5	3.0	4	2.3
MSP	75	43.6	30	17.4	20	11.0	5	3.0

Table 4.5a and 4.5b showed that the majority of RTs (61.0%) who complain of MSDs were young age (40 years or less), of them 43.6% were 30 years and less and 17.4% were between 31 – 40 years old. On the other hand, only 3.0% of participants aged between 51 – 59 years reported MSP.

MSP intensity was moderate among 51.6% of RTs in the age group 30 years and less, 42.2% of the age group 31 – 40 years, 36.0% of the age group 41 – 50 years and 33.3% of the age group 51 – 59, while 28.0% of the age group 41 – 50 years, 21.5% of the age group 30 years and less and 20.0% of the age group 31 – 40 years complained from severe t very severe MSP. This result revealed that the highest complain of MSP was among RTs whose age was 30 years and less.

This result was surprising as the youngest RTs were the highest in their complains (73.1% complain of moderate to very severe pain). This result is inconsistent with the results of Saastamoinen, *et al.*, (2005) which showed that chronic and disabling chronic pain were

more common in older age groups among both genders. Also, the results of El Astal (2010) showed that the highest complain of MSP was among older aged employees (50 years and more), Lorusso *et al*., (2007) reported that age was associated with LBP, the results of Bergman *et al*., (2001) revealed that chronic widespread pain showed a systematic increasing gradient with age and was highest in the age group 59-74 yrs and the results of Salaffi *et al*., (2005) showed that MSP prevalence increased significantly with age. In contrast, the result of the current study were consistent with Al Nawajha (2011) which showed that the highest complain of pain was among nurses aged between (31 – 40 years) and the results of Lorusso *et al*., (2010) showed that there were no significant differences in pain related to age.

This result could be attributed to the assumption that younger age RTs are doing much more X-ray procedures, while older aged RTs carrying out more managerial responsibilities. Also, older aged RTs accounts only 5.2% of the total study participants and the majority of RTs were young. Statistically talking, even though there were differences in complaints of MSP between age groups, but these differences were not significant as Chi square was 12.646 and *P* value = 0.395.

4.2.6 MSP and years of experience

Table (4.6a): Distribution of MSP according to years of experience (n = 172)

Experience in years	**1 - 7**		**8 – 14**		**15 - 21**		**22 – 30**	
	Freq.	% within total	Freq.	% within total	Freq.	% within total	Freq.	% within total
No pain	23	13.4	11	6.4	5	2.9	3	1.7
MSP	77	44.7	27	15.7	16	9.3	10	5.8
Total	100	58.1	38	22.1	21	12.2	13	7.5

Table (4.6b): Distribution of pain intensity according to years of experience (n = 172)

Experience in years	**1 - 7**		**8 – 14**		**15 - 21**		**22 – 30**	
Pain intensity	Freq.	% within exp. years	Freq.	% within exp. years	Freq.	% within exp. years	Freq.	% within exp. years
No pain	23	23.0	11	28.9	5	23.8	3	23.1
Mild	7	7.0	2	5.3	3	14.3	2	15.4
Moderate	50	50.0	16	42.1	8	38.1	5	38.5
Severe	16	16.0	8	21.1	4	19.0	2	15.4
Very severe	4	4.0	1	2.6	1	4.8	1	7.7
Total	100	100.0	38	100.	21	100.0	13	100.0
Chi square = 4.797					***P* value = 0.964**			

Table (4.6a) showed that the highest complain of MSP 44.7% was among RTs with 1 – 7 experience years and the lowest complain was among those with experience 22 – 30 years.

Table (4.6b) showed that 50.0% of RTs who have experience between 1 – 7 years, 42.1% of those who have experience between 8 – 14 years, 38.1% of those who have experience between 15 – 21 years and 38.5% of those who have experience between 22 – 30 years were complaining of moderate MSP. On the other hand, 20.0% of RTs who have experience between 1 – 7 years, 23.7% of those who have experience between 8 – 14 years, 23.8% of those who have experience between 15 – 21 years and 23.1% of those who have experience between 22 – 30 years were complaining of severe to very severe MSP.

Even though there were differences in frequency and percentage of MSP between different years of experience, but these differences were not statistically significant as Chi square was 4.797 and *P* value = 0.964.

The above results indicated that the highest complain of MSP was among RTs with less years of experience and the lowest complain was among RTs with highest years of experience. this result could be attributed to the fact that more than half (58.1%) of study participants have experience ranged between 1 – 7 years. This result was inconsistent with the results of Masoud (2004) which showed that 52.7% of the study sample who complained of LBP have been employed for (7 years and above), 33.8% had (4-6 years) and 13.5% had (1- 3 years).

On the other hand, the results of this study were inconsistent with the results of El Astal (2010) which showed that the lowest complain of MSP was among RTs who have been

employed for 5 years and less and the highest complain was among those who have been employed for 11 years and more.

4.3 Characteristics of MSP

4.3.1 Nature of pain

Table (4.7): Distribution of MSP according to its nature

Variable	Nature of pain				Total	
	Continuous		Intermittent			
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	22	16.9	75	57.7	97	74.6
Female	5	3.8	28	21.5	33	25.4
Chi square = 7.354				***P* value = 0.025**		
Years of experience						
1 – 7	13	10.0	64	49.2	77	59.2
8 – 14	7	5.4	20	15.4	27	20.8
15 – 21	5	3.9	11	8.5	16	12.4
22 – 30	2	1.6	8	6.1	10	7.7
Chi square = 2.759				***P* value = 0.838**		

Table 4.7 showed that the majority of RTs 79.2% have intermittent pain (57.7% for male and 21.5% for female RTs) while 20.7% have continuous pain (16.9% for male and 3.8%

for female RTs). Differences in nature of pain were significant in favor of male RTs as Chi square = 7.354 and *P* value = 0.025.

The results also showed that the highest frequency of complaining of intermittent pain (49.2%) was among RTs who have 1 – 7 years of experience, followed by those who have 8 – 14 years of experience. Differences in nature of pain in relation to experience years were not significant as Chi square = 2.759 and *P* value = 0.838.

This result agrees with the results of El Astal (2010) which showed that the majority of Lab. technicians 91.1% complain of intermittent pain and 8.9% complain of continuous pain. The results of El Keshawi (2008) showed that 88.2% of participants complained of intermittent pain and 11.8% continuous pain.

4.3.2 Location of pain

Table (4.8): Distribution of MSP according to its location

Variable	Location of pain					
	Right side		Left side		Both sides	
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	27	20.8	14	10.8	56	43.1
Female	8	6.8	7	5.4	18	13.9
Total	35	27.6	21	16.2	74	57.0
Chi square = 7.370				***P* value = 0.061**		

Variable	Location of pain					
	Right side		Left side		Both sides	
	Freq.	%	Freq.	%	Freq.	%
Years of experience						
1 – 7	17	13.1	11	8.5	49	37.7
8 – 14	8	6.1	5	3.9	14	10.7
15 – 21	6	4.6	3	2.3	7	5.4
22 – 30	4	3.2	2	1.6	4	3.2
Chi square = 4.775				***P* value = 0.853**		

Table 4.8 showed that 27.6% of study participants who complained of MSP, have their pain in the right side, 16.2% in the left side and 57.0% in both sides. Differences in site of pain were not significant as Chi square = 7.370 and *P* value = 0.061.

The highest complain was among RTs with 1 – 7 years of experience, of them, 13.1% have their pain in the right side, 8.5% in the left side and 37.7% in both sides. Differences in site of pain in relation to years of experience were not significant as Chi square = 4.775 and *P* value = 0.853.

The above results showed that pain radiated to right side more than left side – even though differences were not significant - . this result could be attributed to the fact that the majority of people are right sided and the use of muscles of the right side of the body is more frequent compared to left side, which in turn adds extra stretch on right side and in consequence more pain.

4.3.3 Duration of pain

Table (4.9): Distribution of MSP according to its duration

Variable	Duration of pain				
	Since 1 week	**Since 1 month**	**Since 3 months**	**Since 6 months**	**More than 6 months**
Gender					
Male	2.3	7.7	10.0	12.3	42.3
Female	0.8	3.9	2.3	4.6	13.9
Total	3.1	11.6	12.3	16.9	56.2
Chi square = 7.825			***P* value = 0.251**		
Years of experience					
1 – 7	1.3	7.7	9.2	12.3	28.5
8 – 14	0.8	3.1	3.1	2.3	11.5
15 – 21	0.8	0.8	0	2.3	8.5
22 – 30	0	0	0	0	10.7
Chi square = 22.168			***P* value = 0.225**		

Table 4.9 showed that (56.2%) of study participants have their pain for more than 6 months, of them 42.3% were male and 13.9% were female. Differences were not significant as Chi square = 7.825 and *P* value = 0.251. Also, those with least years of experience (1 – 7 years) have the highest frequency of complains (28.5%) and those with experience 15 – 21 years have the lowest frequency of pain (8.5%). Differences were not significant as Chi square = 22.168 and *P* value = 0.225.

This result indicated that more than half of study participants have chronic MSP (more than 6 months) (www.Aboutcom, 2005), which in consequence may affect their efficiency and productivity. This result is higher than those of El Astal (2010) which reported that 21.1% of study participants have their pain for more than 6 months, but the results of current study were consistent with the results of Masoud (2004) which showed that 56.9% of study participants suffered from pain for more than 6 months. The results of Bergman, *et al*. (2001) showed that 23.9% of study participants have chronic regional pain and 11.4% have chronic widespread pain.

4.3.4 Time of pain occurrence

Table (4.10): Distribution of MSP according to time of occurrence

Variable	Time of pain				
	Before work	**During work**	**After work**	**Before sleep**	**All the time**
Male	0.8	16.1	18.5	13.9	25.4
Female	0	9.2	5.4	0.8	10.0
Total	0.8	25.3	23.9	14.7	35.4
Chi square = 14.201			***P* value = 0.014**		
Years of experience					
1 – 7	0	15.4	15.4	7.0	21.5
8 – 14	0	6.8	6.8	2.3	6.8
15 – 21	0.8	2.3	1.6	3.9	3.9
22 – 30	0	1.6	0.8	1.6	3.9
Chi square = 15.384			***P* value = 0.424**		

Table 4.10 showed that 35.4% of study participants complain of pain all the time, 25.3% have pain during work, 23.9% have pain after work and 14.7% before sleep. Differences in timing of pain occurrence in relation to gender were significant as Chi square = 14.201 and *P* value = 0.014. on the other hand differences in pain in relation to experience years were not significant as Chi square = 15.384 and *P* value = 0.424.

The above results revealed variations in pain characteristics. These differences could be related to differences in employees' adaptation abilities and their tolerance in performing required tasks.

4.3.5 Onset of pain

Table (4.11a): Distribution of MSP according to its onset

Variable	Did MSP started before working in radiology department?				Total	
	Yes		No			
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	9	6.9	88	67.7	97	74.6
Female	4	3.1	29	22.3	33	25.4
Total	13	10.0	117	90.0	130	100.0
Chi square = 7.391				***P* value = 0.060**		

Variables	Did MSP started before working in radiology department?				Total	
	Yes		No			
	Freq.	%	Freq.	%		
Years of experience						
1 – 7	13	10.0	64	49.2	77	59.2
8 – 14	0	0	27	20.7	27	20.7
15 – 21	0	0	16	12.3	16	12.3
22 – 30	0	0	10	7.7	10	7.7
Chi square = 24.575				***P* value = 0.003**		

Table 4.11 showed that 90.0% (67.7% male and 22.3% female) of RTs have developed MSP after they get the job in radiology department. Differences were not significant as Chi square = 7.391 and *P* value = 0.060. On the other hand, the highest frequency 49.2% of RTs who developed pain after they started working in radiology department have experience between 1 – 7 years. Differences were significant as Chi square = 24.575 and *P* value = 0.003.

This result could be attributed to the fact that the majority of workload and heavy tasks are performed by newly employed RTs, while those with long years of experience have more administrative and managerial tasks.

The above result indicated that the majority of study participants developed pain after being employed in radiology department. This result agreed with the results of El Astal (2010)

which showed that 83.7% of lab. Technicians' developed MSP after being employed in laboratory. These results could be related to poor designs of radiology departments, poor body postures during work and improper use of body mechanics.

Table (4.12): Distribution of MSP in regard to rest

Variable	Did MSP relived by rest?				Total	
	Yes		No			
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	78	60.0	19	14.6	97	74.6
Female	29	22.3	4	3.1	33	25.4
Total	107	82.3	23	17.7	130	100.0
Years of experience						
1 – 7	65	50.0	12	9.2	77	59.2
8 – 14	22	17.0	5	3.9	27	20.9
15 – 21	11	8.5	5	3.9	16	12.4
22 – 30	9	7.0	1	0.8	10	7.8

Table 4.12 showed that 82.3% of those who have pain reported that pain was relieved by rest, while pain was not relieved among 17.7% of them. This result emphasizes the need to take breaks / time off during work to alleviate or prevent pain occurrence. The study conducted by Hung *et al*., (2009) focused on this point and found that 44.3% of study

participants were able to take time off during work shifts, which helped in preventing pain occurrence.

The researcher thinks that affording break time for a short periods during work time will allow for some relaxation and alleviation of pain and re-energizing of staff personnel to continue their work without complains.

4.4 Risk factors of musculoskeletal disorders

Table (4.13): Response of participants on risk factors of MSDs

Risk factor	Yes (%)
Bending and twisting	88.4
Carrying cassettes and heavy objects	85.5
Lifting and transferring patients	77.9
Psychological pressure	77.3
Unsuitable work environment (lighting, ventilation …)	74.4
Sudden movements	73.9
Crowd and inadequate space	72.1
Inadequate rest periods during work	70.3
Wearing lead apron for long time	54.7
Wearing uncomfortable shoes	51.2
Uncooperative colleagues	44.2
Sitting for long time to do procedures for patients	32.6
Office work (computer, typing, statistics ..)	19.2

The results showed that bending and twisting (88.4%) was the major risk factor perceived by study participants, followed by carrying cassettes and heavy objects (85.5%), lifting and transferring patients (77.9%), psychological pressure (77.3%), unsuitable work environment (74.4%) and sudden movements (73.9%). In contrast, office work and sitting for long time were the lowest risk factors.

The study results were supported by some previous studies including the study conducted by Choobineh *et al*. (2010) which reported that pulling / pushing heavy objects, moving heavy loads, repetitive motions, bending and twisting posture, were significantly associated with musculoskeletal symptoms. The study of Punnett & Wegman (2004), indicated that different risk factors at work may cause MSDs including rapid work pace, repetitive motion, non-neutral body postures and vibration. The study of Windt, *et al*., (2000) showed that potential risk factors included heavy work load, unsuitable postures, repetitive movements, vibration and duration of employment. The study of Bongers *et al*. (2002) found an association between psychosocial factors and MSP. Perceived workload, time pressure, low control on the job and poor social support were among factors associated with musculoskeletal disorders.

4.5 Workplace characteristics

Table (4.14): Study participants perception of workplace characteristics

Work environment characteristics	Gender	Very suitable	Suitable	Unsuitable	Absolutely unsuitable	Total %
Department design	Male	27.2	43.4	24.3	5.1	100.0
	Female	16.7	50.0	30.6	2.8	100.0
Lighting	Male	6.6	31.6	54.4	7.4	100.0
	Female	8.3	36.1	50.0	5.6	100.0
Ventilation	Male	27.2	39.7	27.9	5.1	100.0
	Female	22.2	47.2	30.6	0.0	100.0
Safety measures	Male	22.8	43.4	30.1	3.7	100.0
	Female	13.9	44.4	33.3	8.3	100.0
Space	Male	35.3	41.9	19.9	2.9	100.0
	Female	33.3	22.2	36.1	8.3	100.0
Floor	Male	24.3	27.2	40.0	8.1	100.0
	Female	16.7	22.2	52.8	8.3	100.0
Staff number	Male	14.0	30.9	44.1	11.0	100.0
	Female	22.2	16.7	50.0	11.1	100.0
Chi square = 24.722				**P value = 0.170**		

Study participants perception of their work environment was varied, 68.65% of RTs (70.6% males and 66.7% females) reported that their department design was suitable or very suitable, 68.15% of RTs (66.9% males and 69.4% females) reported that ventilation was suitable or very suitable, 62.25% of RTs (66.2% males and 58.3% males) reported that

safety measures were suitable or very suitable and 66.35 of RTs (77.2% males and 55.5% females) reported that space was suitable or very suitable. On the other hand, 58.7% of RTs (61.8% males and 55.6% females) reported that lighting in their workplace was unsuitable, 54.6% of RTs (48.1% males and 61.1% females) reported that the floor in their workplace was unsuitable(this result could be attributed to the assumption that females usually wear high-heeled shoes which is unsuitable for the department floor) and 58.1% of RTs (55.1% males and 61.1% females) reported that staff number was unsuitable .

The results did not show significant differences in environmental perception between male and female RTs as Chi square = 24.722 and P value = 0.170.

The above result indicate that multiple risk factors were perceived as causing MSP. Some studies are supporting this result including the study of Morken, *et al*., (2007) examined risk factors at work, the types of exposures most frequently reported as the cause of disorders were high physical workload 38%, repetitive work 26%. The study of Punnett & Wegman (2004) revealed that different risk factors at work may cause MSDs including rapid work pace, repetitive motion, non-neutral body postures and vibration. The study of Windt, *et al*., (2000) showed that potential risk factors included heavy work load, unsuitable postures, repetitive movements, vibration and duration of employment. The results of Salik and Özcan (2004) revealed that lifting, maintaining a position for prolonged period of time, performing repetitive tasks and transferring patients were the determinants of exacerbated symptoms during clinical practice.

4.6 Medical advice

Table (4.15): Frequency of seeking medical advice among RTs who have MSDs (n = 130)

Seeking medical advice	Male			Female			Total	
	Freq.	% within total	% within gender	Freq.	% within total	% within gender	Freq.	% within total
Yes	82	63.1	86.31	25	19.2	71.42	107	82.3
No	13	10.0	13.69	10	7.7	28.57	23	17.7
Total	95	73.1	100.0	35	26.9	100.0	130	100.0

Table 4.15 showed that 107 (82.3%) of RTs who have MSDs went to the physician for medical advice due to MSP, of them, 82 (63.1%) were male and 25 (19.2%) were female.

When looking to each gender alone, the results showed that 86.31% of male RTs and 71.42% of female RTs who complain of MSP sake medical advice.

This result indicated that pain and discomfort was severe enough to cause RTs to seek medical advice to relieve their pain. This result raised the question of the role of ergonomic education / instructions regarding the proper use of musculoskeletal system and proper postures during work. Also, this result emphasize on the importance of using proper body mechanics when lifting and transferring heavy objects.

Table (4.16): Type of medical advice (n = 107)

Medical advice	Male (n = 82)		Female (n = 25)	
	Freq.	% within gender	Freq.	% within gender
Included medication	73	89.02	22	88.0
Physiotherapy	55	67.07	14	56.0
Surgical intervention	8	9.75	1	4.0
Rest	76	92.68	25	100.0
Advice relieved pain	65	79.26	24	96.0

Table 4.16 showed that among male RTs who complained of MSP, 89.02% got medication, 67.07% had physiotherapy, 9.75% had surgery, 92.68% had rest and the prescribed advice relived pain for 79.26% of them. Regarding female RTs, 88.0% got medication, 56.0% had physiotherapy, 4.0% had surgery, 100.0% had rest and prescribed advice relieved pain for 96.0% of them.

This result is higher than the results of Choobineh, *et al*., (2010) which showed that 38.5% of OR nurses had to visit a physician, 25.1% took rest, 18.8% needed physiotherapy and 57% believed that MSP would cause them to change their jobs.

Table (4.17): Sickleave due to MSP (n = 130)

	Male		Female		Total	
	Freq.	%	Freq.	%	Freq.	%
Did you get sickleave due to pain?						
Yes	46	35.4	16	12.3	62	47.7
No	51	39.2	17	13.1	68	52.3
Number of sickleave days						
1 – 5 days	25	19.2	10	7.7	35	26.9
6 – 10 days	13	10.0	5	3.8	18	13.8
More than 10 days	8	6.1	1	0.8	9	6.9

Table 4.17 showed that, due to pain, 47.7% of RTs got sickleave, 35.4% of them were male and 12.3% were female RTs. Regarding number of sickleave days, 19.2% of male RTs and 7.7% of female RTs got 1 – 5 days, 10.0% of male RTs and 3.8% of female RTs got 6 – 10 days and 6.1% of male RTs and 0.8% of female RTs got more than 10 days sickleave.. This result is supported by the results of Fiell *et al*., (2007) which reported that there was a strong association between long-term sick leave and high musculoskeletal pain. The results of this study were higher than that of El Astal (2010) showed that 17.9% of Lab. technicians got sickleave due to pain, 14.6% got sick leave between (1 – 5) days, 2.4% get between (6 – 10) days, 0.8% get more than 10 days. The results of Labriola (2006) showed that the mean sickleave days due to pain was 6.27 days, 60.9% reported one or more days of sickness absence, 20% of the employees accounted for 80% of total days of sickness absence. Also, the results Masoud (2004) showed that 30.8 % of participants had sick leave

due to pain. Also, the results of Morken, *et al*., (2003) showed that MSD accounted for 45% of all working days lost in the last year.

These results should highlight the need for modifying work conditions inorder to decrease the number of sickleave days (lost working days) among health care providers, because these lost days should be compensated, which in turn will add extra costs on the budget of health institutions. According to Occupational Safety and Health Administration (OSHA), MSDs cost US industry $15 – 20 billion in worker's compensation costs with total costs as high as $ 45 – 60 billion per year (Kullin and Reaston, 2011). The cost of sickleave days in Palestinian health institutions have not been studied and it is underestimated.

4.7 Suggestions to decrease MSDs

Table (4.18): Ranking of participants' suggestions to decrease MSDs

Rank	Suggestion / recommendation	Very important	Important	Moderately important	Not important	Absolutely not important	mean
1	Decrease No. of X-Ray procedures	83.7	11.6	3.5	1.2	0	4.779
2	Distribute work tasks	74.4	22.1	2.9	0.6	0	4.703
3	Avoid lifting heavy objects	70.9	26.7	2.3	0	0	4.686
4	Afford facilities for transferring pts. and heavy objects	72.7	22.7	4.1	0.6	0	4.674
5	Stop working when pain occurs	67.4	29.7	2.9	0	0	4.645
6	Wearing comfortable clothes and shoes	62.2	29.1	6.4	2.3	0	4.511
7	Avoid sudden movements	54.7	34.3	9.9	1.2	0	4.424
8	Change position frequently	42.4	37.2	16.3	4.1	0	4.180
9	Increase number of RTs in the radiology department	39.5	38.4	11.6	8.1	2.3	4.046
10	Decrease No. of working hours	39.0	37.3	23.3	8.1	2.3	3.924

When asking study participants to rank suggestions to decrease MSP, the highest priority was for decreasing the number of radiology procedures performed each day (m = 4.779), followed by distributing work tasks between RTs (m = 4.703), avoid lifting heavy objects (m = 4.686), afford facilities for transferring patients and heavy objects (m = 4.674), stop working when pain occurs (m = 4.645), wearing comfortable clothes and shoes (m =

4.511), avoid sudden movements (m = 4.424), change position frequently (m = 4.180), increase number of RTs in radiology department (m = 4.046) and finally decrease number of working hours (m = 3.924). These results somehow consistent with the results of El Astal (2010) which showed that the highest priority was for task rotation, followed by practicing some exercise to relax body muscles, avoid sudden movements, stop working when the pain starts, change position frequently during work, wear comfortable shoes, afford comfortable chairs and take rest time / break during the shift. The results of Al Nawajha (2011) showed that the highest priority was for providing adequate staff in operating room, followed by taking breaks during work, reduce number of surgical procedures per day, reduce working hours, wear comfortable shoes and clothes during work, using lifting assistance devices for lifting and moving patients, avoid sudden movements, avoid comfortable chairs, change position frequently, stop working when pain starts and practice some exercise during work. The above results did not show much variations between the current study and the study of El Astal (2010) and Al Nawajha (2011). Some suggestions were present in the three studies including, avoiding sudden movements, wearing comfortable clothes and shoes, stop working when pain starts, taking breaks during work.

From the researcher's experience, it was noticed that there is a high number of radiology procedures done daily and reach some times more than 60 procedures. Also, assignments and tasks were not distributed equally, as some RTs will do most of the radiology procedures and some RTs perform few procedures. These factors may be a cause of MSP among RTs.

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

This study was conducted to identify the most common MSDs among radiology technicians working at Gaza governmental hospitals. The study explored the prevalence of MSDs and pain characteristics in relation to some demographic variables including gender, age and years of experience. The findings of the study highlighted some factors and work conditions that may lead to developing MSDs. These findings might help decision-makers to act toward improving work environment and reduction of risk factors to alleviate or decrease the chances for developing MSDs to the lowest possible level.

The study sample consisted of 172 radiology technicians from all Gaza governmental hospitals (136 male and 36 female), of them 75.6% complained of MSP. The prevalence of MSP was higher among female RTs compared to male RTs (71.3% of male RTs and 91.7% of female RTs complained of MSP).

Regarding severity of pain, 59.7% of male and 63.6% of female RTs complained of moderate pain, while 23.8% of male RTs and 21.2% of female RTs complained of severe pain. Back was the dominant site of MSP (31.5%) and stiffness was the highest type of complains (40.76%).

Among those who complained of MSP, 61.0% were young (40 years or less), of them 43.6% were (30 years and less), 17.4% were between (31 – 40 years old) and only 3.0%

were between (51 – 59 years old). Regarding years of experience, the highest complain 44.7% was among RTs with the least years of experience (1 – 7) years and the lowest complain was among those with the highest years of experience (22 – 30) years.

The majority of RTs 79.2% have intermittent pain and 20.7% have continuous pain. Pain radiated to the right side among 27.6% of study participants who complained of MSP, radiated to the left side among 16.2% and 57.0% in both sides. Pain lasted for more than 6 months among 56.2% of study participants, of them 42.3% were male and 13.9% were female. Pain continued all the time among 35.4% of study participants, 25.3% have pain during work, 23.9% have pain after work and 14.7% before sleep.

Regarding onset of pain, 90.0% of study participants developed MSP after they get the job in radiology department and 82.3% reported that pain was relieved by taking a break during work.

Study participants perceived bending and twisting as the major risk factor (88.4%). Other risk factors included carrying cassettes and heavy objects (85.5%), lifting and transferring patients (77.9%), psychological pressure (77.3%), unsuitable work environment (74.4%) and sudden movements (73.9%). The lowest risk factors were office work (19.2%) and sitting for long time (32.6%).

Regarding perception of workplace environment, 70.6% of male and 66.7% of female RTs reported that their department design was suitable, 66.9% of male and 69.4% of female RTs reported that ventilation was suitable, 66.2% of male and 58.3% of female RTs reported that safety measures were suitable, 77.2% of male and 55.5% of female RTs reported that

space was suitable, while 61.8% of male RTs and 55.6% of female RTs reported that lighting was unsuitable, 48.1% of male RTs and 61.1% of female RTs reported that department floor was unsuitable and 55.1% of male RTs and 61.1% of female RTs reported that staff number was unsuitable.

Pain and discomfort caused 62.2% of all RTs to visit a physician for medical advice, of them, 47.7% were male and 14.5% were female. The medical management included medication, surgical intervention, physiotherapy and rest. Due to pain, 47.7% of RTs got sickleave, of them, 19.2% of male and 7.7% of female RTs got 1 – 5 days, 10.0% of male and 3.8% of female RTs got 6 – 10 days and 6.1% of male and 0.8% of female RTs got more than 10 days sickleave. These lost working days are adding extra cost on the budget of health facilities and there is a need to study it in more depth.

To decrease MSP and its consequences, study participants suggested decreasing the number of radiology procedures performed each day (m = 4.779), distributing work tasks between RTs (m = 4.703), avoiding lifting heavy objects (m = 4.686), afford equipments for transferring patients and heavy objects (m = 4.674), stop working / taking a break when pain occurs (m = 4.645), wearing comfortable clothes and shoes (m = 4.511), avoid sudden movements (m = 4.424), change position frequently (m = 4.180), increase number of staff in radiology department (m = 4.046) and finally decrease number of working hours (m = 3.924).

5.2 Recommendations

In the light of the study results, the researcher recommends the following:

- Equal distribution of assignments and tasks among RTs, taking in consideration staff abilities and skills.
- Offer break times during work for relaxation to avoid overstretching of muscles.
- Implementing educational programs regarding ergonomic issues to reduce pain and discomfort, including proper handling and transferring of patients and proper postures and movements.
- Periodic assessment of radiology departments to ensure proper and safe workplace environment.
- Establish a tool scale to measure the degree of applying safety measures during work.
- Measuring workload in comparison to staff number

5.3 Suggestions for further studies

- To conduct assessment studies regarding suitability of radiology department (workplace environment) for safe practicing.
- To carry out studies to explore the impact of psychological stress on performance among radiology technicians.

- To conduct a study to examine the level of knowledge, attitudes and practice (KAP) about safety measures during work.

- To carry out a meta-analysis study including all local studies concerning musculoskeletal pain among different professions.

- To conduct a wide study to assess the prevalence of musculoskeletal disorders among different specialties in health team (physicians, nurses, laboratory technicians, radiology technicians).

References

Abdul-Jabbar, T. (2008). Musculoskeletal Disorders among Dentists in Saudi Arabia. **Pakistan Oral and Dental Journal**. Vol. 28(1): 135-144.

Abu Rayya, F. (1999). Prevalence of Low Back Pain among health professionals at health department. UNRWA, Gaza Field. **MPH Thesis**, Al Quds University.

Al Nawajha, S. (2011). Determinants of Low Back Pain among Operating Room Nurses in Gaza Governmental Hospitals. **MPH Thesis**, Al-Quds University, Jerusalem, Palestine.

Badley, E.M. *et al*., (1994). Relative importance of musculoskeletal disorders as a cause of chronic health problems, disability, and health care utilization: findings from the 1990 Ontario Health Survey. **Journal of Rheumatology**, Vol.21 (3): 505-514.

Bakker, EW. *et al*., (2009). Spinal mechanical load as a risk factor for low back pain: a systematic review of prospective cohort studies. **Spine Journal**, Vol.34 (8): 281-293.

Bergman, S. *et al*. (2001). Chronic musculoskeletal pain, prevalence rates, and sociodemographic associations in a Swedish population study. **J Rhematol**; Vol. 28(6): 1369 – 1377.

Bernard, B. (1997). Musculoskeletal disorders and workplace factors. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity and low back. **U.S. Department of Health and Human Services (DHHS).** Publication No. 97-141.

Bevan, S. *et al*., (2009). Fit for work? Musculoskeletal disorders in the European workforce. **London: The Work Foundation**. http://www.theworkfoundation.com/Assets/Docs/Fit%20for%20Work%20pan European%20report.pdf (accessed 22 February 2011).

Bongers, PM. *et al*., (2006). Epidemiology of work related neck and upper limb problems: Psychosocial and personal risk factors (Part I) and effective interventions from a bio-behavioral perspective (Part II). **J Occup Rehabil**, Vol. 16(3): 272-295.

Bongers, PM. *et al*. (2002). Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow, or hand/wrist?: A review of the epidemiological literature, **Am J Ind Med**, Vol. 41: 315 – 342.

Bos, E. *et al*., (2007). Risk factors and musculoskeletal compliant in non specialized nurses, ICU nurses, operating room nurses and X-ray technologists. **International Arch Occupational Environmental Health,** Vol. 80: 198-206.

Buckle, P. (2005). Ergonomics and musculoskeletal disorders: overview. **Occup Med**, Vol. 55(3): 164-167.

Campo, M. *et al*., (2008). Work-related Musculoskeletal Disorders in Physical Therapists: A prospective Cohort Study with 1- year follow up. **Physical Therapy Journal,** Vol. 88(5): 608-619.

CCOHS Canadian Center for Occupational Health & Safety (2005). Work related Musculoskeletal Disorders.

http://www.ccohs.ca/oshanswers/diseases/rmirsi.html. Accessed 2 March 2011.

Chao, S. *et al*., (2004). Musculoskeletal Disorders: Does the Osteopathic Medical Profession Demonstrate Its Unique and Distinctive Characteristics. **The journal of American Orthopedic Association,** Vol.104 (4): 149-155.

Chavez, C. (2005). Lifting Safety and ergonomics. Back injury risks in radiological technologists. **Business Journal, Radiologic Technology**, July- August , 2005.

Choobineh, A. (2010). Perceived demands and musculoskeletal disorders in operating room nurses of Shiraz City Hospital, Industrial Health, Vol. 48: 74 – 84.

Chris, J. *et al*., (2002). Musculoskeletal pain. **British Medical Journal**, Vol. 325: 534-537.

David, T. (2002). **Musculoskeletal Disorders**. http://www.healthline.com/galecontent/Musculoskeletal disorders. Accessed 24.2. 2011.

Directorate General of Hospitals, MOH, (2010).

Dougherty, P. (2009). Musculoskeletal Disorders and Chiropractic. **American public Health Association publications.**

Egwu, O.A. *et al*., (2006). Prevalence of neck, upper back and chest musculoskeletal symptoms among medical students in Ebonyi state. **Journal Experimental and Clinical Anatomy** . Vol. 5 (1): 41 – 43.

El Astal, E. (2010). Determinants of musculoskeletal pain among governmental hospitals laboratory technicians in Gaza governorates. **MPH Thesis**. Al-Quds University, Jerusalem, Palestine.

El Keshawi, A. (2008). Neck pain and work-related factors among administrative and academic staff of the Islamic University of Gaza. **MPH Thesis**. Faculty of education. The Islamic University- Gaza.

El-Tayeb, S. *et al*., (2008). Complaints of the arm, neck and shoulder among computer office workers in Sudan: a prevalence study with validation of an Arabic risk factors questionnaire. **Environ Health Journal**, Vol. 7: 33.

European Foundation for the Improvement of Living and Working Condition. (2006-2007), **Annual review of Working Condition in European Union**. http://www.eurofound.europa.eu. Accessed 6 M arch 2011.

Fiell, Y. *et al*. (2007). Self-reported musculoskeletal pain and working conditions among employees in the Swedish public sector, **Work**, Vol. 28(1): 33 – 46.

Finnish Centre for Pensions (2008). **Statistical year book of pensioners in Finland**, 2007.Helsinki.

Gregory, V. (1998). Musculoskeletal Injuries: An Occupational Health and Safety issue in Sonography, **Sound Effects**, Vol. 30. (www.soundergonomics.com) accessed 22.9.2011.

Hales, T. and Bertsche, K. (1992). Management of upper extremity cumulative trauma disorders. **American Association of Occupational Health Nurses**, Vol.40(30): 118-127.

Harkness, EF. *et al*., (2004). Mechanical injury and psychosocial factors in the work place predict the onset of widespread body pain: a two-year prospective study among cohorts of newly employed workers. **Arthritis Rheum Journal**, Vol. 50(5): 1655-1664.

Hartvigsen, J. *et al*., (2005). Small effect of genetic factors on neck pain in old age: a study of 2,108 Danish twins 70 years of age and older. **Spine,** Vol. 30 (2): 206-208.

Haukka, E. (2010). Musculoskeletal disorders and psychosocial factors at work: Effects of participatory ergonomics intervention in a cluster randomized controlled trial, **Academic Dissertation**, Department of public health, University of Helsinki.

Hedge, A. (2000). **Back Care for Nurses**. http://www.spineuniverse.com/wellness/ergonomics/back-care-nurses. Accessed 18 March 2011.

Human Rights Council (2010).Annual Report.

Hung, Wen Kao, *et al*., (2009). Work-related Musculoskeletal Disorders among Medical Staff in a Radiology Department. **Journal of Medical Science**, Vol. 29(3): 119-124.

Jacewicz, M. (2006). **Symptoms and diagnosis of musculoskeletal disorders**. Merck-Manual. http://www.merckmanual.com/home/sec05/ch059/ch059b.html. accessed 20.3.2011.

Jouda, A. (2006). Occupational hazards among governmental health care workers in Gaza Strip. **MPH Thesis**, Jerusalem, Palestine.

Khan, C. and Scott, L. (2008). **Musculoskeletal System Introduction: Introduction**. NJ, USA: Merck & Co., Inc. http://en.wikipedia.org/Human_musculoskeletal_system. Accessed 20.3. 2011.

Kauppila, L. (2009). Atherosclerosis and disc degeneration/low-back pain--a systematic review. **Eur J Vasc Endovasc Surg**, Vol. 37(6): 661-670.

Klussman, A. *et al*., (2008). Musculoskeletal symptoms of the upper extremities and the neck: Across-sectional study on prevalence and symptom-predicting factors at visual display terminal workstation. **Biomedical Central Journal**, Vol.9: 96.

Kullin, J. and Reaston, M. (2011). Musculoskeletal disorders early diagnosis: A retrospective study in the occupational medicine setting, **Journal of Occupational Medicine and Toxicology,** Vol. 6:1. (www.occup-med.com/content/6/1/1). Accessed 22.9.2011.

Kumar, S. *et al*. (2004). Morbidity among X-ray technologists. **International Journal of Industrial Ergonomics,** Vol.33(1): 29-40.

Kumar, S. *et al*. (2003). Perceived physical stress at work and musculoskeletal discomfort in X-ray technologists, **Ergonomics**, Vol. 5;47(2): 189 – 201.

Labriola, M. (2006). Work environment factors associated with long-term sickness absence and return to work, **Ph.D. Thesis**, Institute of Public Health, University of Copenhagen.

Leino, PI. and Hanninen, V. (1995). Psychosocial factors at work in relation to back and limb disorders. **Scand J Work Environ Health**, Vol. 21(2): 134-142.

Leveille, S. *et al*., (2005). Sex differences in musculoskeletal pain in older adults, **Pain**, 116(3): 332 – 338.

Levin, K. (2006). Study design III: Cross-sectional studies. **Evidence-Based Dentistry**, Vol. 7: 24-25.

Lipscomb, J. *et al*., (2002). Work-schedule characteristics and reported musculoskeletal of registered nurses. **Scandinavian Journal of Work Environmental Health**, Vol. 28(6): 349-401.

Loisel, P. et al., (2001). Implementation of a participatory ergonomics program in the rehabilitation of workers suffering from subacute back pain. Applied Ergonomics, Vol. 32(1): 53 – 60.

Lorusso, A., *et al*., (2010). Musculoskeletal compliant among Italian X-ray technologists students: A cross sectional questionnaire survey. **Biomedical Central Journal**, Vol. 3: 114-118. (www.biomedcentral.com) accessed 19.9.2011.

Lorusso, A., *et al*., (2007). Musculoskeletal compliant among Italian X-ray technologists. **Industrial Health**, Vol. (45)5: 705-708.

Lorusso, A. *et al*. (2007). A review of low back pain and musculoskeletal disorders among Italian nursing personnel, **Industrial Health**, Vol. 45(5): 637 – 644.

Lubbad, S. (2006). The effect of waste water treatment plant effluent (chemical quality) on underground water in Gaza City. **MPH Theses**. Al-Quds University, Palestine.

Macfarlane, GJ. *et al*. (2009) Evaluation of work-related psychosocial factors and regional musculoskeletal pain: results from a EULAR Task Force**. Annual Rheumatic Disease,** Vol.68(6): 885-891.

Magnago, S. *et al*., (2010). Nursing workers: Work conditions, social demographic characteristics and skeletal muscle disorders. **Acta Paul En Ferm Journal**, Vol. 23(2): 187-198.

Marcus, M. *et al*., (2002). A prospective study of computer users: Postural risk factors of musculoskeletal symptoms and disorders. **American Journal of Industrial Medicine**, Vol. 41: 236 – 249.

Marras, SW. *et al*., (2009): Musculoskeletal disorder health research. National occupational research agenda (NORA) future directions in occupation. **Applied Ergonomics**, Vol. 40(1): 15-22.

Masoud, F. (2004). Prevalence and risk factors for low back pain among physical therapy Professionals in Gaza Strip. **Master Thesis**. Islamic University. Gaza.

Matthew, T.(2008): About.com. August 07, 2008

Maul, I. *et al*., (2003). Course of low back pain among nurses, a longitudinal study across eight years. **Journal of Occupational and environmental medicine**, Vol. 60: 497 – 503.

Maumet, S., *et al*. (2005). **Risk factors related to Musculoskeletal Disorders in health care workers,** Archives des Maladies Professionnelles et de L'environnement.

Medical Encyclopedia. (2010). **Muscloskeletal.** http://www.answer.com.topic/musco-skeletal. accessed 3.3. 2011.

Medicinenet (2011). **Management of musculoskeletal pain**. http://www.medicinenet.com/pain_management_musculoskeletal_pain/article.htm. Accessed 22 March 2011.

Michael, *et al*., (2008) Prevalence and Risk Factors Associated With Low Back Pain among Health Care Providers in a Kuwait Hospital. **Spine.** Vol. 33(5): 539-545.

Michael, J. (2006). **Symptoms and diagnosis of musculoskeletal disorders**. http://www.merckmanuals.com/home/sec05/ch059/ch059c.html. Accessed 13.3. 2011.

MOH, (2006). Health Status In Palestine. Annual Report 2005 Gaza: Palestinian Health Information Center.

MOH, (2004). Annual report.

Morken, T. *et al*., (2007). Work-related musculoskeletal disorders in Norway's offshore petroleum industry. **Occupational Medicine Journal**, Vol. 57(2): 112-117.

Morken, T. *et al*., (2003). Low back pain and widespread pain predict sickness absence among industrial workers. **Biomedical Central Journal**, Vol. 4. 21. (www. Biomedicentral.com) accessed 22.9.2011.

NIAMS National Institute of Arthritis and Musculoskeletal and Skin Diseases, (2010). Handout on Health: Back Pain. U.S. Department of Health and Human Services. NIH Publication No. 05–5282.

NIOSH (1997). Musculoskeletal disorders and workplace factors: A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Publication No. 97,141.

Novak, C.B. (2004). Upper extremity work-related musculoskeletal disorder: a treatment perspective. **Journal of Orthopedic, Sports and physiotherapy**, Vol. 34 (10): 628-637.

Nygren, A., (1995). Neck and shoulder pain: an increasing problem. Strategies for using insurance material to follow trends. **Scand Journal Rehabil Med Supple**, Vol. 32: 107-112.

Nyland, LJ. and Grimmer, KA. (2003). Is undergraduate physiotherapy study a risk factor for low back pain? A prevalence study of LBP in physiotherapy students.

Biomedical Central Journal Musculoskeletal Disorders, Vol. 4(22): 1471-2474.

OSHA Occupational Health and Safety Administration, (2010). European Risk Observatory Report. www.osha.europa.eu/en/publications/reports/TERO09009ENC. Accessed 15.2. 2011.

OSHA Occupational Health and safety Administration, (2007). Musculoskeletal Disorders. www.osha.europa.eu/en/publication/reports/en_TE8107132ENC.pdf. Accessed 22.3.2011.

Paananen, MV. *et al.*, (2010). Psychosocial, mechanical, and metabolic factors in adolescents' musculoskeletal pain in multiple locations: A cross-sectional study. **European Journal of Pain**, Vol. 14(4): 395-401.

Palestine, Ministry of Health and European Commission (2004). **Health Sector Review, Task Force 2:** Health Sector Financing.

PCBS Palestinian Central Bureau of Statistics, (2009). Annual report, Ramallah, Palestine.

PCBS Palestinian Central Bureau of Statistics, (2007). Population, Housing and Establishment Census. Palestine.

PCBS Palestinian Central Bureau of Statistics, (2006). Demographic health survey-2004, final report. Ramallah- Palestine.

Patel, A.T. and Ogle, A.A.: Diagnosis and Management of Acute Low Back Pain". American Academy of Family Physicians. Retrieved March 12, 2007. (http://en.wikipedia.org/wiki/Back_pain) accessed 20.9.2011

Podniece, Z. (2008). Work-related musculoskeletal disorders: prevention report. Luxembourg. **European Agency for Safety and Health at Work**.

Polit, D. (2004). **Nursing research: principles and methods**, 7th Ed., Lippincott, New York, USA.

Punnett, L. *et al*., (2005). Estimating the global burden of low back pain attributable to combined occupational exposures. **Am J Ind Med**, Vol. 48(6): 459-469.

Punnett, L. and Wagman, D. (2004). Work related Musculoskeletal Disorders: the epidemiological evidence and the debate. **Journal of Electromyography and Kinesiology,** Vol. 14 (1): 13-23.

Riihimaki, H. (2005). Musculoskeletal disorders. In: Ahrens W, Pigeot I, eds. **Handbook of epidemiology. Berlin: Springer,** 1443-1472.

Rocha, L. *et al*., (2005). Risk factors of musculoskeletal symptoms among call center operators of a bank in Sao Paulo, Brazil, **Industrial Health**, Vol. 43: 637 – 646.

Rollman, B. and Lautenbacher, S. (2001). Sex Differences in Musculoskeletal Pain. **The Clinical Journal of Pain,** Vol.17(1): 20-24.

Rozenfeld, V. et al., (2009). Prevalence, Risk Factors and Preventive Strategies in Work-Related Musculoskeletal Disorders among Israeli Physical Therapists. **Physiotherapy Research International Journal,** Vol. 15(3): 176-184.

Rugelj, D. (2003). Low back pain and other work-related musculoskeletal problems among physiotherapists. **Applied Ergonomics**, Vol.34: 635-639.

Saastamoinen, P. *et al*., (2005). Socio-economic differences in the prevalence of acute, chronic and disabling chronic pain among ageing employees. **Pain**, Vol. 114(3): 364-371.

Salaffi, F. *et al*. (2005). Prevalence of musculoskeletal conditions in an Italian population sample: results of a regional community-based study, **Clin Exp Rheumatol**, Vol. 23(6): 819 – 828.

Salik, Y. and Özcan, A. (2004). Work-related musculoskeletal disorders : A survey of physical therapists in Izmir-Turkey**. Musculoskeletal Disorders. Biomedical Central Journal**, Vol.5(27): 1471 - 2474.

Shiri, R. *et al*., (2010a). The Association Between Obesity and Low Back Pain: A Meta-Analysis. **Am J Epidemiol**, Vol. 171(2),: 135-154.

Shiri, R. *et al*., (2010 b). The association between smoking and low back pain: a meta-analysis. **Am J Med**, Vol.123(1): 87.

Skinner, H. (1996). **Current Diagnosis and Treatment in Orthopedics**, 1st ed. Mass Publishing Co., p.p.183.

Smith, D. *et al*., (2006). Musculoskeletal disorders and their after-effects among health professionals in Beijing. **Occupational Ergonomics Journal**, Vol. 6(1): 25-34.

Smith, D. *et al*. (2004). Musculoskeletal disorders among professional nurses in mainland China.. **Journal of Professional Nursing**, Vol. 20(6): 390-395.

Spry, C. (2009). **Essentials of perioperative nursing**, 4th ed. New York, Jones and Bartlett Publishers, LLC. USA.

Strazdins, L and Bammer, (2004). Women, work and musculoskeletal health. **Soc Sci Med**. Vol. 58(6): 997-1005.

Szymanska, J. (2002). Disorder of the musculoskeletal system among dentists from the aspects of ergonomics and prophylaxis. **Ann Agric Environ Med**, Vol. 9: 169-173.

Taimela, S. *et al*., (2007). Self-rated disability due to musculoskeletal disorders at work and during leisure time. In: Kaila-Kangas, L. Musculoskeletal disorders and diseases in Finland. Results of the Health 2000 Survey. **Publications of the National Public Health Institute.**

UNEP (2003): Disc study on the environment in the occupied Palestinian territories.

USDL United States Department of Labor, Occupational Outlook Handbook, 2010 – 2011 Edition.

WHO, (2009). Gaza Strip Initial Health Needs Assessment.

WHO, (1985). Identification and Control of Work-Related Diseases. Geneva, Switzerland: World Health Organization. WHO Technical Report Series 714.

Wihlidal and Bertsche (1997). An injury Profile of practicing diagnostic sonographer in Alberta. **International Journal of industrial Ergonomics**, Vol. 19: 126-205.

Wijnhoven, H. *et al.* (2006). Prevalence of musculoskeletal disorders is systematically higher in women than in men, **Clinical Journal of Pain,** Vol. 22(8):717-724.

Wikipedia, (2011). **Musculoskeletal disorders**. http://en.wikipedia.org/wiki/Musculskeletal- disorders. Accessed 2.3.2011.

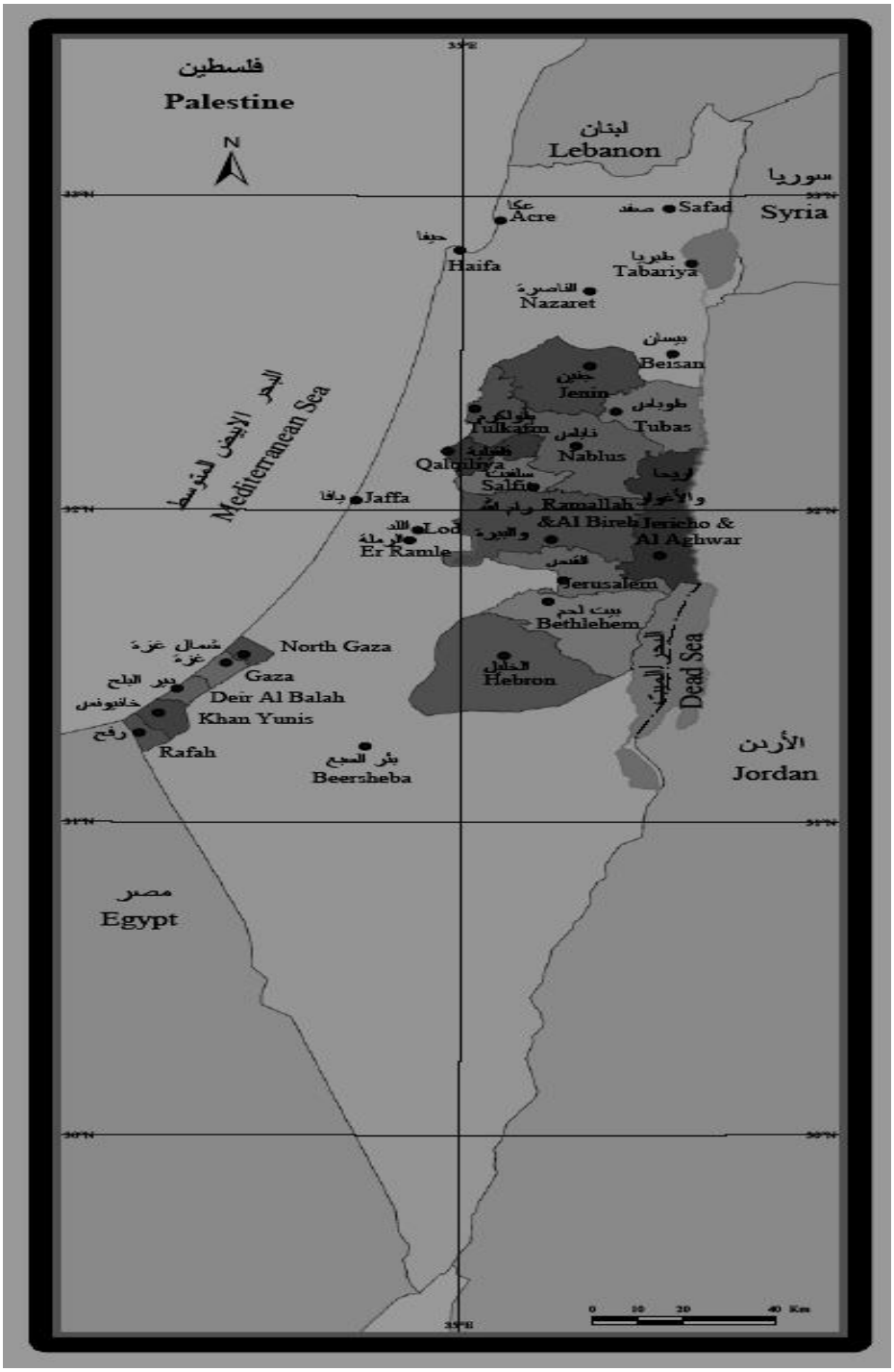
Windt, DA. *et al*. (2000). Occupational risk factors for shoulder pain: A systematic review**. Occupational Environment Medicine**, Vol.57(7): 433-442.

www.Aboutcom. 2005. (accessed 12.10.2011).

www. MedConditions.net. dictionary of medical conditions terminology. Accessed 3.6.2011.

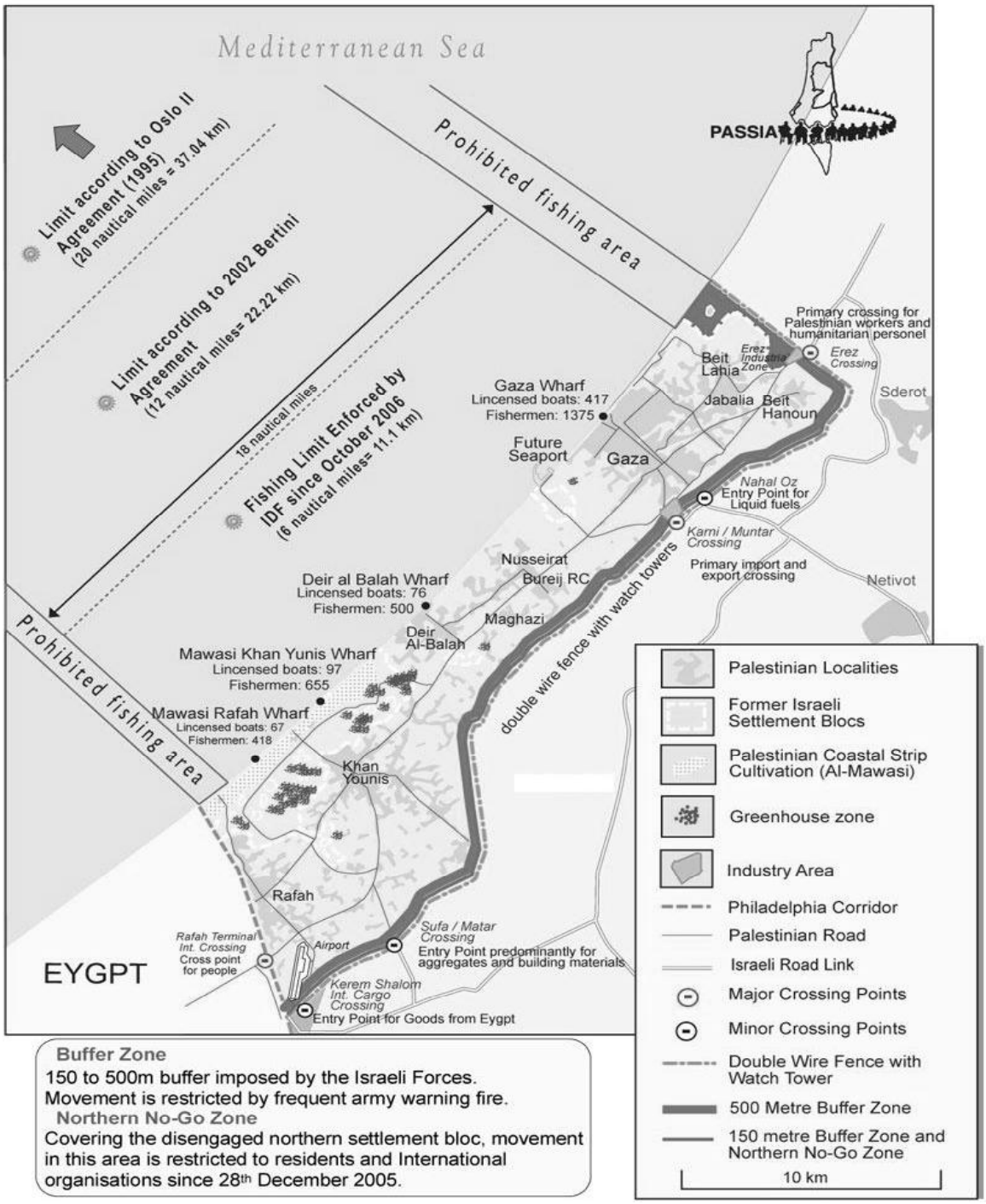
www.medicinenet.com. (2009). Accessed on 26.3.2009.

Annex (1): Map of Palestin



Annex (2): Map of Gaza strip

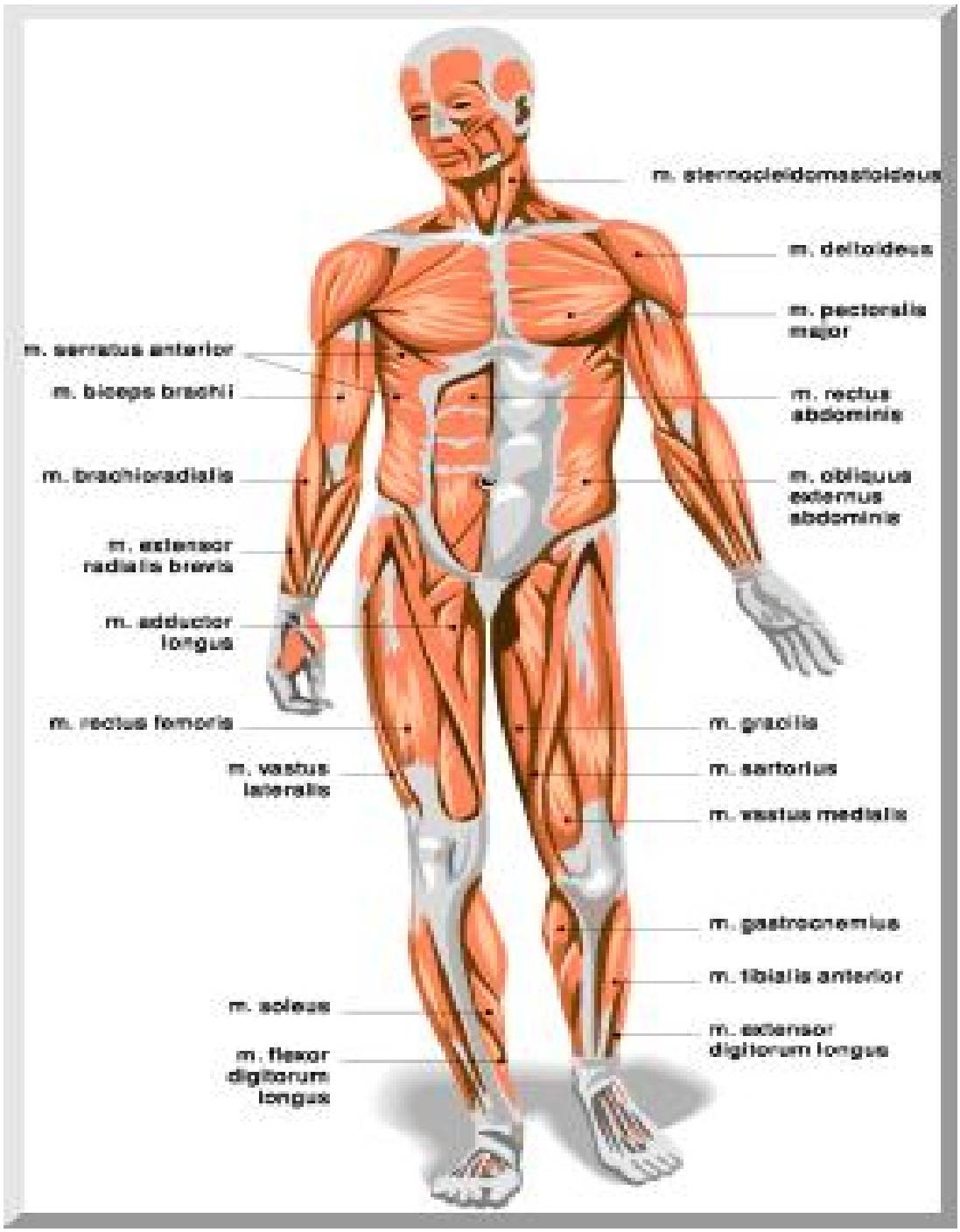
The Gaza Strip 2007



Buffer Zone
150 to 500m buffer imposed by the Israeli Forces. Movement is restricted by frequent army warning fire.

Northern No-Go Zone
Covering the disengaged northern settlement bloc, movement in this area is restricted to residents and International organisations since 28th December 2005.

Annex (3):Muscular system



Annex (4): Expert panel names

Member	Place of Work
1- Dr. Yousef Aljeesh	Islamic University
2- Dr. Yehia Abed	Al-Quds University
3- Dr. Abd-Alaziz Thabet	Al-Quds University
4- Dr. Yousef Abu Safeyah	Al-Quds University
5- Dr. Mohamed Alsoltan	Al Azhar University
6- Dr. Fadel Naiem	Islamic University
7- Dr. Raied Aljazar	MOH- Gaza
8- Mr. Yasser Alajrami	Al-Azhar University
9- Mr. Abd-Alrahim Shaqura	European Gaza Hospital
10- Mr. Jamal Alshareef	Nasser Medical Complex

Annex (5): Questionnaire (Arabic version)

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الزملاء الأفاضل ..... الزميلات الفاضلات

السلام عليكم ورحمة الله وبركاته

تقوم الباحثة بإعداد رسالة ماجستير بعنوان

Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals- Gaza Governorates

"اضطرابات العضلات الحركية لدي فنيي الأشعة العاملين في المستشفيات الحكومية بمحافظات غزة"

إن هذا البحث يشكل جزء ضروري من دراستي للحصول على درجة الماجستير في الصحة العامة مسار الإدارة الصحية - كلية الصحة العامة بجامعة القدس.

وقد تم اختياركم ضمن مجموعة العاملين في مراكز الأشعة في المستشفيات الحكومية للإجابة على العبارات الواردة في هذه الاستبانة.

إذا كنت توافق على المشاركة في هذه الدراسة، يرجى التكرم بقراءة العبارات التالية بدّقة والإجابة عنها بموضوعية لما في ذلك من أثر كبير على صحة النتائج والنصائح التي سوف تتوصل إليها الباحثة. مع التأكيد بأن هذه البيانات سوف تستخدم لأغراض البحث العلمي فقط، وسيتم التعامل معها بسرية تامة.

لا داعي لكتابة الاسم

☐ أوافق ☐ لا أوافق

ملاحظة / الوقت اللازم لتعبئة الإستبانه كاملة لا يستغرق أكثر من 20 دقيقة.

أشكركم على حسن تعاونكم

الباحثة

بسمة طلعت الأغا

إستبانة اضطرابات العضلات الحركية لدي فنيي الأشعة العاملين في المستشفيات الحكومية بمحافظات غزة

الرقم: .....

الجزء الأول :

1. البيانات الشخصية:

- الجنس ☐ ذكر ☐ أنثى
- العمر بالسنوات: ..... سنة
- الحالة الاجتماعية ☐ أعزب /آنسة ☐ متزوج/ة ☐ أرمل/ة
- المؤهل العلمي ☐ دبلوم ☐ بكالوريوس ☐ دراسات عليا
- متوسط الدخل الشهري: ..... شيكل

2. الممارسات والعادات

- هل تمارس/ ي الرياض ☐ نعم ☐ لا
- إذا كانت الإجابة نعم حدد/ ي نوع الرياضة

☐ المشي / الجري ☐ تمارين رياضية ☐ كرة قدم ☐ كرة سلة / طائرة

3. معومات عن مكان العمل

- اسم المستشفى الذي تعمل/ي به .....
- عدد ساعات العمل اليومي..... ساعة
- هل تعمل ساعات إضافية بالمستشفى بعد ساعات العمل اليومي: ☐ نعم ☐ لا
- إذا كانت الإجابة "نعم"، كم ساعة إضافية تعمل أسبوعياً ..... ساعة
- هل تعمل في وظيفة إضافية خارج نطاق العمل الرسمي بالمستشفى ☐ نعم ☐ لا
- إذا كانت الإجابة "نعم" حدد/ ي نوع العمل ☐ في مجال الأشعة ☐ حرفي آخر
- عدد الحالات التي تصورها يومياً: .....
- عدد سنوات الخبرة في قسم الأشعة: ..... سنة

الجزء الثاني: خصائص اضطرابات العضلات الحركية

➢ هل تعاني/ين من اضطرابات العضلات الحركية (ألام في الرقبة ،الأكتاف ، ألام الظهر)

☐ نعم ☐ لا

إذا كانت الإجابة " بنعم" أكمل/ي تعبئة الاستبانة مباشرة

إذا كانت الإجابة " لا" انتقل/ي للجزء الرابع وأكمل/ي تعبئة الاستبانة

➢ **حدد/ي مكان الألم الذي تعاني/ين منها الآن أو التي عانيت/ي منها (يمكنك اختيار أكثر من إجابة)**

الظهر	الرقبة	الأكتاف

4. كيف توصف/ين شدة الألم؟

خفيفة	متوسطة	شديدة	شديدة جداً

5. حدد/ي طبيعة الألم الذي تعاني/ين منه الآن أو عانيت/ي منه؟

مستمر (دائم)	متقطع

6. إلي أين يمتد الألم؟

الجانب الأيمن	الجانب الأيسر	كلا الجانبين

7. حدد/ي نوع الألم الذي تعاني/ين منها الآن أو التي عانيت/ي منها(يمكنك اختيار أكثر من إجابة)

خذلان	حرقان	وخز	شد عضلي	نمنمة

8

. حدد/ي مدة ظهور الألم الذي تعاني/ين منه الآن أو عانيت/ي منه؟

منذ أسبوع	منذ شهر	منذ 3 شهور	منذ 6 شهور	أكثر من ذلك

9 . حدد/ي وقت ظهور الألم الذي تعاني/ين منه الآن أو عانيت/ي منه؟

أثناء العمل	قبل النوم	بعد النوم	في كل الأوقات

10. هل بدأ الألم قبل العمل في قسم الأشعة الحالي؟ ☐ نعم ☐ لا

11. هل أخذت إجازة مرضية بسبب تلك الآلام في السنة الماضية؟ ☐ نعم ☐ لا

12. إذا كانت الإجابة نعم ما عدد هذه الأيام ☐ **1- 5 أيام** ☐ **6- 10 أيا** ☐ **أكثر من 10 أيام**

الجزء الثالث: العوامل المسببة لاضطرابات العضلات الحركية

اختر/اختاري العوامل التي ترى/ن أنها قد سببت لك اضطرابات في العضلات الحركية في العمل.

م	العامل / العوامل المسببة	نعم	لا	لا اعلم
1	الازدحام في مكان العمل وعدم وجود مساحة تتيح حرية للحركة			
2	ارتداء الواقي الرصاصي (lead apron) لفترات طويلة أثناء العمل			
3	الحركات المفاجئة أثناء العمل			
4	الانحناء والالتفاف أثناء العمل			
5	حمل كاسيتات التصوير والمعدات الثقيلة أثناء العمل			
6	زيادة العمل المكتبي (عمل حاسوب وطباعة ، إحصائيات ....)			
7	ارتداء أحذية غير مريحة أثناء العمل			
8	الجلوس لفترات طويلة أمام الكمبيوتر لإجراء بعض الفحوصات للمرضى			
9	بيئة العمل غير ملائمة مثل (الإضاءة، التهوية، درجة الحرارة)			
10	حمل ونقل المرضى خلال العمل			
11	عدم التعاون من قبل الزملاء			
12	الضغط النفسي			
13	عدم وجود فترات استراحة كافية أثناء العمل			

الجزء الرابع: خصائص بيئة العمل

الرقم	الخاصيــة	مناسبة تماماً	مناسبة	غير مناسبة	غير مناسبة تماماً
1	مواصفات قسم الأشعة				
2	الإضاءة في مكان العمل				
3	التهوية في مكان العمل				
4	مستوى الأمان الصحي في القسم				
5	مساحة القسم بالنسبة لعدد المرضى				
6	أرضية القسم				
7	عدد الموظفين العاملين بالقسم				

الجزء الخامس: النصائح الطبية والعلاج

هل تلقيت نصيحة طبية أو علاج لألمك؟ ☐ **نعم** ☐ **لا**

- **إذا كانت الإجابة نعم حدد /ي نوع النصيحة**

م	العبـــارة	نعم	لا
1	تضمنت النصيحة أدوية وعقاقير لتسكين الألم		
2	تضمنت النصيحة علاج طبيعي		
3	تضمنت النصيحة عملية جراحية		
4	تضمنت النصيحة راحة		
5	النصيحة الطبية قللت من الألم بدرجة ملحوظة		

الجزء السادس: الاقتراحات والتوصيات

من فضلك اختر/ي الإجابة التي تراها/ترينها مناسبة لتقليل حدوث اضطرابات العضلات الحركية حسب درجة الأهمية

م	الاقتراح / التوصية	مهم جداً	مهم	متوسط الأهمية	غير مهم	غير مهم نهائياً
1	تقليص عدد ساعات العمل اليومية					
2	زيادة عدد الموظفين في قسم الأشعة					
3	ارتداء أحذية وملابس مريحة أثناء العمل					
4	تجنب الحركات المفاجئة أثناء العمل					
5	تغيير وضعية جسمك باستمرار أثناء العمل					
6	التوقف عن العمل عند حدوث الألم					
7	تجنب حمل الأشياء الثقيلة					
8	توفير أدوات لنقل المرضى والمعدات الثقيلة					
9	ترشيد استهلاك فحوصات الاشعة					
10	توزيع مهام العمل					

دمتم بصحة وعافية

بسمة طلعت الأغا

Annex (6): Questionnaire (English version)

Serial number: …….

Questionnaire for Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals- Gaza Governorates

Part A: Personal & Demographic data:

- Gender ☐ Male ☐ Female
- Age in years ..... years
- Weight .....kg
- Marital status ☐ single ☐ Married ☐ Divorce ☐ Widow
- Are you Pregnant? ☐ Yes ☐ No
- If "yes "number of previous pregnancies …….
- Qualification: ☐ Diploma ☐ Bachelor ☐ Postgraduate

Habits And Practices

- Are you smoker? ☐ yes ☐ No
- If answer is" yes" Number of smoked years : ……years .
- Do you practice sport? ☐ Yes ☐ No
- If the answer is "yes" define sport kind ☐ walking ☐ Running ☐ Balls sports ☐ karate ☐ weight lifting

Information about Work Place

- Place of work "Hospital's Name": ……
- Job type : ☐ Routine-ray ☐ CT ☐ Fluoroscopy ☐ Dark room ☐ Operating Room
- Number of work hours per day..... hours.
- Number of cases radiograph per day..... case.
- Do you work overtime hours in this hospital? ☐ Yes ☐ No

- If yes, how many hours per week …… hours
- Do you have another job after your formal work? ☐ Yes ☐ No
- If yes, describe ☐ in radiology field ☐ another field
- If another field (specify).....
- Number of experiences years in Radiology Department..... years.

Do you have Musculoskeletal Disorders (MSD_s) :(Low back pain, shoulder pain, neck pain)?

☐ **Yes** ☐ **No**

- **If the answer is yes, please go to <u>part (B)</u> and continue.**
- **If the answer is No, please skip to <u>part (E)</u> and continue.**

<u>Part B</u>: characteristics of musculoskeletal Disorders

1. Site of pain (you can choose more than one)

Back pain	**Neck pain**	**Shoulder pain**

2. Severity of pain

Mild	**Moderate**	**Severe**

3. Course of pain:

Continuous	**Intermittent**

4. Pain radiation

Rt. Side	Lt. side	Both sides	Not radiate

5. Type of pain (you can choose more than one)

Numbness	Burning	Tingling	Stiffness/spasm	Not clear

6. Duration of pain

Since 1 week	Since 1 month	Since 3 month	Since 6 months	More than 6 months

7. Onset of pain

At work	At end of work	After rest	Before sleeping	All times

8. Did MSDs appear before you work in radiology department?

☐ **Yes** ☐ **No**

9. Did you get sick leave due to MSD_s in the last year?

☐ **Yes** ☐ **No**

10. If the answer is "yes" how many days?

☐ **1-5 days** ☐ **6- 10 days** ☐ **More than 10 days**

Part C: Risk factors of LBP: (In your case, which of the following factors caused your pain?) *please mark the ones suits you.*

No	Risk factor / cause	Yes	No	Don't Know
1	Bending and twisting			
2	Carrying cassettes and heavy objects			
3	Lifting and transferring patients			
4	Psychological pressure			
5	Unsuitable work environment (lighting, ventilation …)			
6	Sudden movements			
7	Crowd and inadequate space			
8	Inadequate rest periods during work			
9	Wearing lead apron for long time			
10	Wearing uncomfortable shoes			
11	Uncooperative colleagues			
12	Sitting for long time to do procedures for patients			
13	Office work (computer, typing, statistics ..)			

Part D: Work environment characteristics

Work environment characteristics	Very suitable	Suitable	Unsuitable	Absolutely unsuitable
1- Department design				
2- Lighting				
3- Ventilation				
4- Safety measures				
5- Space				
6- Floor				
7- Staff number				

Part .E: Seeking medical advice or treatment

Have you got medical advice or treatment for your discomfort or pain?

☐ **Yes** ☐ **No**

If your answer" yes" please specify type of advice

Sr	Statement	Yes	No
1	Advice included drug or medication to relieve pain		
2	Advice included surgery		
3	Advice included physiotherapy		
4	Advice included rest		
5	Did the prescribed medical advice reduce pain		

Part. F: suggestion and recommendation to reduce MSD_s

Rank	Suggestion / recommendation	Very important	Important	Moderately important	Not important	Absolutely not important
1	Decrease No. of X-Ray procedures					
2	Distribute work tasks					
3	Avoid lifting heavy objects					
4	Afford facilities for transferring pts. and heavy objects					
5	Stop working when pain occurs					
6	Wearing comfortable clothes and shoes					
7	Avoid sudden movements					
8	Change position frequently					
9	Increase number of RTs in the radiology department					.
10	Decrease No. of working hours					

Annex(7): Approval from Helsinki Committee

Palestinian National Authority
Ministry of Health
Helsinki Committee

السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

التاريخ : **07/03/2011**

Name: **Basma El Agha**

الاسم: **بسمة الاغا**

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

" Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals- Gaza Governorates."

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

In its meeting on March 2011

and decided the Following:-

To approve the above mention research study.

و ذلك في جلستها المنعقدة لشهر 3 2011

و قد قررت ما يلي:-

الموافقة على البحث المذكور عاليه.

Signature
توقيع

Member
عضو

Member
عضو

Chairperson

Conditions:-

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

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Annex(8): Ethical Approval from Alquds University

Al-Quds University
Jerusalem
School of Public Health

جـامـعـة الـقـدس
القدس
كلية الصحة العامة

التاريخ: 2011/6/25

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

الموضوع: مساعدة الطالبة بسمة الأغا

تقوم الطالبة المذكورة أعلاه بإجراء بحث بعنوان:

"Musculoskeletal Disorders among Radiological Tehnologists at Governmental Hospitals- Gaza Governorates"

كمتطلب للحصول على درجة الماجستير في الصحة العامة-مسار الإدارة الصحية. و عليه نرجو التكرم للإيعاز لمن ترونه مناسب لتسهيل مهمة الطالبة في جمع البيانات اللازمة من أقسام الأشعة بالمستشفيات التابعة لوزارتكم الموقرة.
علماً بأن المعلومات ستكون متوفرة لدى الباحثة و الجامعة فقط.

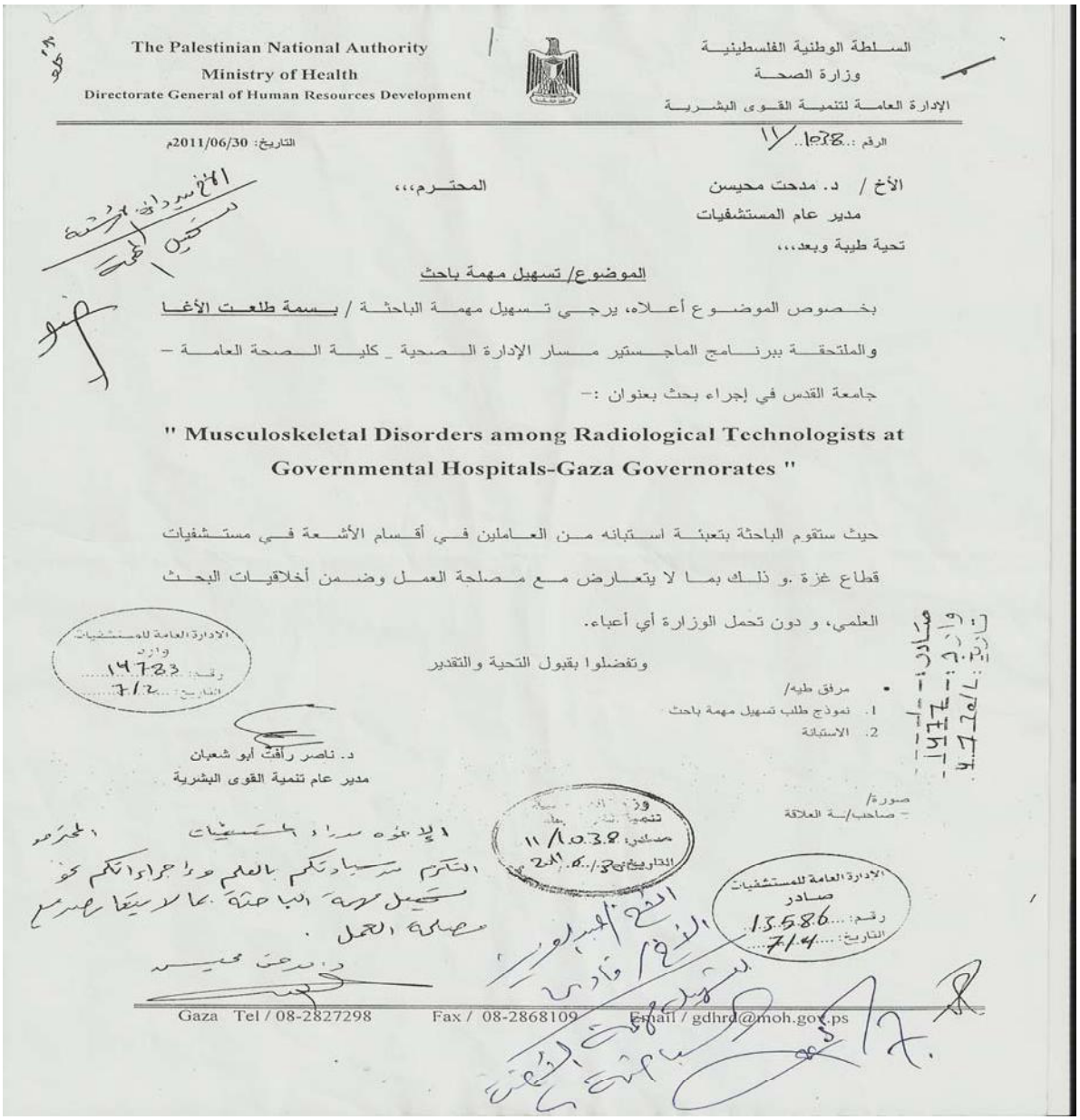
و اقبلوا فائق التحية و الاحترام،،،

د. بسام أبو حمد
منسق عام برامج الصحة العامة

نسخة:
- الملف

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

Annex(9):Ethical Approval from Director General of Human Resources Development



The Palestinian National Authority
Ministry of Health
Directorate General of Human Resources Development

السلطة الوطنية الفلسطينية
وزارة الصحة
الإدارة العامة لتنمية القوى البشرية

الرقم :..1038../11

التاريخ: 2011/06/30م

الأخ / د. مدحت محيسن
مدير عام المستشفيات

المحترم،،،

تحية طيبة وبعد،،،

الموضوع/ تسهيل مهمة باحث

بخصوص الموضوع أعلاه، يرجى تسهيل مهمة الباحثة / بسمة طلعت الأغا والملتحقة ببرنامج الماجستير مسار الإدارة الصحية _ كلية الصحة العامة – جامعة القدس في إجراء بحث بعنوان :-

" Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals-Gaza Governorates "

حيث ستقوم الباحثة بتعبئة استبانه من العاملين في أقسام الأشعة في مستشفيات قطاع غزة .و ذلك بما لا يتعارض مع مصلحة العمل وضمن أخلاقيات البحث العلمي، و دون تحمل الوزارة أي أعباء.

وتفضلوا بقبول التحية والتقدير

- مرفق طيه/
1. نموذج طلب تسهيل مهمة باحث
2. الاستبانة

صورة/
- صاحب/ـة العلاقة

الإدارة العامة للمستشفيات
وارد
رقم: 14783
التاريخ: 7/12

د. ناصر رأفت أبو شعبان
مدير عام تنمية القوى البشرية

صادر - وارد
رقم: 14777
التاريخ: 4/7/2011

وزارة الصحة
تنمية القوى البشرية
صادر: 1038
التاريخ: 30/6/2011

الإدارة العامة للمستشفيات
صادر
رقم: 13586
التاريخ: 7/4

Gaza Tel / 08-2827298 Fax / 08-2868109 Email / gdhrd@moh.gov.ps

Annex (10): Request for approval from MOH

بسم الله الرحمن الرحيم

السيد/ د. يوسف ابو الريش المحترم

مدير عام مجمع ناصر الطبي – وزارة الصحة

بواسطة السيد/ د. خالد صهير المحترم

مدير دائرة الأشعة – مجمع ناصر الطبي

تحية طيبة وبعد ...

الموضوع : طلب تسهيل مهمة الباحثة بسمة طلعت الأغا

بداية نثمن جهودكم من اجل العمل على تطوير الكادر الطبي في وطننا الحبيب

وحيث تقوم الباحثة المذكورة أعلاه بإجراء دراسة بعنوان:

Musculoskeletal Disorders among Radiological Technologists at Governmental Hospitals – Gaza Governorates

" اضطرابات العضلات الحركية لدي فنيي الأشعة العاملين في المستشفيات الحكومية – محافظات غزة"

كمتطلب للحصول على **درجة الماجستير في الصحة العامة – مسار الإدارة الصحية** وعليه أرجو من سيادتكم التكرم للإيعاز للدكتور ناصر أبو شعبان – مدير عام تنمية القوي البشرية لتسهيل مهمة الباحثة حسب ما يراه مناسبا و أنه لا مانع لديكم من الموافقة على منحي الفرصة لاستكمال الدراسة والتي ستتم من خلال جمع المعلومات و توزيع الاستبيانات على جميع فنيي الأشعة العاملين في المستشفيات الحكومية في محافظات غزة

واقبلوا فائق التحية,...

مقدمة الطلب

بسمة طلعت الأغا

Annex(11): Request from Nasser Medical Complex to Director General of Human Resources Development

Palestinian National Authority
Ministry of Health
Hospitals General Administration
Nasser Medical Complex

السلطة الوطنية الفلسطينية
وزارة الصحة
الإدارة العامة للمستشفيات
مجمع ناصر الطبي

25.6.2011

Ref:HD.11.180

السيد/ د.ناصر أبو شعبان المحترم

مدير عام تنمية القوى البشرية

تحية طيبة وبعد،،،

الموضوع/ طلب تسهيل مهمة الباحثة/ بسمة طلعت الأغا

نفيد سيادتكم علماً بأن الموظفة بسمة طلعت الأغا ستقوم بإجراء بحث بعنوان:اضطرابات العضلات الحركية لدى فنيي الأشعة العاملين في المستشفيات الحكومية كمتطلب للحصول على درجة الماجستير في الصحة العامة وعليه نرجو من سيادتكم الإيعاز لأصحاب العلاقة عن تسهيل مهمة الباحثة .

وتفضلوا بقبول فائق الاحترام والتقدير،،،

د. يوسف أبو الريش

مدير عام مجمع ناصر الطبي

وزارة الصحة
الإدارة العامة للمستشفيات
مجمع ناصر الطبي - خان يونس
Nasser Medical Complex - Khan Younis

صادر :- ٩٨٦
وارد :- ...
تاريخ :- ٢٦/٦/٢٠١١

وزارة الصحة - مستشفى ناصر - خانيونس - تليفون ٢٠٥١٢٤٩/٢٠٥١٠٤١/٢/٣ تليفاكس ٢٠٥١٢٤٢/ ٢٠٥٢٧٠٩
Ministry of Health - Nasser Hospital - Khan Younis - tel 2051249/2051041/2/3 - telfax 2051242/2052709

ملخص الدراسة

تعتبر اضطرابات الجهاز الحركي (العضل هيكلي) من المشاكل واسعة الانتشار التي تؤثر علي جودة الحياة والإنتاج. هدفت هذه الدراسة إلي تحديد مدي انتشار اضطرابات العضلات الحركية لدي فنيي الأشعة العاملين في المستشفيات الحكومية بمحافظات غزة، كما هدفت إلي التعرف علي أهم العوامل التي تؤدي لحدوث تلك الاضطرابات، ولتحقيق هذه الأهداف فقد استخدمت الباحثة المنهج الوصفي التحليلي المقطعي عبر عينة للدراسة مكونة من 172 فني أشعة (136 ذكر، 36 أنثي).كما استخدمت الباحثة استبانة لقياس مدي انتشار العضلات ت الحركية بالإضافة لعمل دراسة استطلاعية علي عينة مكونة من 15 فني أشعة بقصد التأكد من صدق وثبات أداة الدراسة مستخدمة اختبار صدق الاتساق الداخلي و معامل ألفا كرونباخ. ولتحليل البيانات استخدمت الباحثة برنامج الرزم الإحصائية للعلوم الإنسانية يالاضافة للمعالجات الإحصائية ، التكرارات، النسب المئوية ومربع كاي.

ومن أهم نتائج الدراسة أن 75.6% من عينة الدراسة يعانون من اضطرابات العضلات الحركية، وهي في الإناث أعلي منها في الذكور(91.7% إناث،71.3%ذكور)،وكانت ألام الظهر الأكثر انتشارا بنسبة بلغت 31.5%، والشد العضلي أكثر أنواع الألم تكرارا بنسبة بلغت 40.76% ،وأن 83.5% من الذكور و 84.4% من الإناث ألامهم بين شديدة ومتوسطة واستمر الألم لمدة تزيد عن 6 اشهر لدي 56.2%من فنيي الأشعة،كما ان 90.0%من المشتكين من ألام العضلات أفادوا بان ألامهم ظهرت بعد البدء بالعمل في قسم الأشعة.

كما انه لايوجد فروق ذات دلالة إحصائية في ألام العضلات الحركية تعزي للجنس والعمر وسنوات الخبرة.

كانت أكثر آلام الجهاز الحركي تكراراً لدى فنيي الأشعة الذين تقل أعمارهم عن 40 عاماً بنسبة بلغت 61.0% وكانت أقلها تكراراً لدى فنيي الأشعة الذين تراوحت أعمارهم بين 51 – 59 عاماً بنسبة بلغت 3.0% فقط، وكان 44.7% من الذين يشتكون من آلام العضلات الحركية ممن تراوحت سنوات الخبرة لديهم بين 1 – 7 سنوات. ومن بين الذين عانوا من آلام الجهاز الحركي فقد طلب 82.3% منهم نصيحة طبية لتخفيف الألم.

وهناك عوامل تؤدي لحدوث اضطرابات في الجهاز الحركي منها الانحناء والالتواء،وهي أكثرها خطرا بنسبة بلغت 88.4%، يليها حمل الأشياء الثقيلة وكاسيتات الأشعة بنسبة بلغت 85.5%،ثم حمل ونقل المرضى بنسبة بلغت 77.9% والضغط النفسي بنسبة بلغت 77.3%، بينما كانت أقل عوامل الخطر الجلوس لفترة طويلة بنسبة بلغت 32.6% والعمل المكتبي بنسبة بلغت 19.2%.

أما بالنسبة لبيئة العمل فقد أفاد58.7% من أفراد عينة الدراسة أن الإضاءة في مكان العمل كانت غير مناسبة،45.6% أفادوا أن أرضية القسم غير مناسبة،و 58.1%أفادوا أن عدد الفنيين في القسم غير كاف.

وبناء علي ما سبق فان الباحثة توصي بضرورة إدخال تعديلات في بيئة العمل (الإضاءة وأرضية القسم) وزيادة عدد العاملين في القسم. أما بالنسبة للاقتراحات للحد من اضطرابات العضلات الحركية فقد أظهرت النتائج ان أهمها تقليل العبء علي العاملين، توزيع المهام بشكل عادل وتجنب حمل الأشياء الثقيلة.