EARLY DETECTION OF WORK-RELATED MUSCULOSKELETAL DISORDERS IN NURSES TRAINING IN HEALTHCARE FACILITIES IN IRAQ: THE CASE OF HILLA HOSPITAL

BY

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The Degree of Master of Science

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2023

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Signature

/ /

Zainab Ali Mohammed AMEEN

ABSTRACT

EARLY DETECTION OF WORK-RELATED MUSCULOSKELETAL DISORDERS IN NURSES TRAINING IN HEALTHCARE FACILITIES IN IRAQ: THE CASE OF HILLA HOSPITAL

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Master of Science in Occupational Health Science

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December2023

In this study, workplace health, safety, and welfare are covered under Occupational Health and Safety (OHS), which serves as a foundation for reducing occupational accidents to an acceptable level. OHS is concerned with the health, safety, and welfare of workers in a variety of industries, and nurses are at the center of health services and contribute to the welfare of societies. Workplaces in the health services sector are complex environments that can be dangerous from time to time, and unsafe working conditions can cause a decrease in the workforce in the health services sector. Decent working conditions in this sector must take into account the health and well-being of workers, as the quality of care provided by health care workers depends in part on the quality of their working environment. Work-related musculoskeletal disorders (WMSDs) are injuries that affect the connective tissues of the body. It is one of the leading causes of occupational injury and disability worldwide. Nurses in Iraq suffer from work-related musculoskeletal disorders due to awkward situations, heavy lifting, and repetitive movements with patients. The main aim of this study was the early detection of work-related musculoskeletal disorders among nurses working at Hilla General Teaching Hospital in Babylon. A descriptive cross-sectional study design was used. The Nordic Musculoskeletal Questionnaire (NMQ) was used to collect information. Musculoskeletal disorders are one of the most common reasons patients seek medical care. Musculoskeletal diseases are still the main source of disability and lost working time. Understanding the reasons, especially work-related reasons, is still the key to primary prevention. This questionnaire covered nine areas of the body (the neck, shoulder, back, elbow, hand/wrist, lower back, hip/thigh, knee, and foot/ankle). It

is a self-reported questionnaire asking if there has been any pain in the past 6 days or year. NMQ was used to collect information from 206 randomly selected nurses from abroad, and the sample size was 400. The research data were analyzed with SPSS for Windows 26.0. The study showed that 60.7% of the nurses were male and 39.3% female. The analysis showed that there was no significant relationship between any age group and education level. Among nurses from any part of the body, the 12-month work-related musculoskeletal prevalence was highest in WMSDs of the low back (51.9%), followed by the neck (37.4%). The main risk factor for WMSDs was exercise. There was a strong correlation between work-related musculoskeletal disorders, age, marital status, education level, seniority, the unit worked in the hospital, smoking, exercise, gender, and work hours ($p \leq 0.05$). The results of our study revealed that only physical exercises predict muscular risks during work (OR = 4.366, CL = 1.569–12.15). The findings of the study can be used by hospital administrators to provide appropriate guidance on treatment strategies for the prevention and management of work-related musculoskeletal disorders among nurses to reduce occupational risks and improve patient care in hospitals.

2023, 66 pages

Keywords: Health workers, Nurses, Work-related musculoskeletal disorder, Risk factors, Musculoskeletal disorders.

ÖZET

IRAK'TAKI SAĞLIK KURULUŞLARINDA EĞİTİM VEREN HEMŞİRELERDE İŞE BAĞLI KAS-İSKELET SİSTEMİ RAHATSIZLIKLARININ ERKEN TESPİTİ: HİLLA HASTANESİ ÖRNEĞİ

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İş Sağlığığ ve Güvenliği, Yüksek Lisans
Tez Danışmanı: Doç. Dr. Semih KUTER
Aralık 2023

Bu çalışmada, İSG, çeşitli sektörlerde çalışanların sağlığı, güvenliği ve refahı ile ilgilenir. Hemşireler sağlık hizmetlerinin merkezinde yer alır ve toplumların refahına katkıda bulunur. Sağlık hizmetleri sektöründeki iş yerleri zaman zaman tehlikeli olabilen karmaşık ortamlardır ve güvenli olmayan çalışma koşulları sağlık hizmetleri sektöründeki iş gücünün azalmasına neden olabilir. Sağlık çalışanlarının sunduğu bakımın kalitesi kısmen çalışma ortamlarının kalitesine bağlı olduğundan, bu sektördeki uygun çalışma koşulları çalışanların sağlığını ve refahını dikkate almalıdır. İşle ilgili kas-iskelet sistemi rahatsızlıkları (KİSH) vücudun bağ dokularını etkileyen yaralanmalardır. KİSH, hastaların tıbbi bakım talep etmelerinin en yaygın nedenlerinden biridir. Nedenlerin, özellikle de işle ilgili nedenlerin anlaşılması, birincil önlemenin anahtarı olmaya devam etmektedir. KİSH, dünya genelinde mesleki yaralanma ve sakatlıkların önde gelen nedenlerinden biridir. Irak'taki hemşireler, garip durumlar, ağır kaldırma ve hastalarla tekrarlayan hareketler nedeniyle işle ilgili kas-iskelet sistemi rahatsızlıklarından muzdariptir. Bu çalışmada, iş kazalarının kabul edilebilir bir düzeye indirilmesi için sağlık kuruluşlarında eğitim veren hemşirelerin İş Sağlığı ve Güvenliği (İSG) kapsamında Kas-İskelet Sistemi rahatsızlıklarının erken teşhisi ele alınmaktadır. Farklı bir anlatımla bu çalışmanın temel amacı, Irak'taki sağlık kuruluşlarında eğitim veren (ve özellikle Hilla Genel Eğitim Hastanesi'nde çalışan) hemşirelerde yaşanabilicek KİSH erken tespitidir. Araştırmada tanımlayıcı kesitsel bir çalışma tasarımı kullanılmıştır. Bilgi toplamak için İskandinav Kas-iskelet Anketi (NMQ) kullanılmıştır. Bu anket vücudun dokuz bölgesini (boyun, omuz, sırt, dirsek,

el/bilek, bel, kalça/uyluk, diz ve ayak/ayak bileği) kapsamaktadır. Anket, son 6 gün veya bir yıl içinde herhangi bir ağrı olup olmadığını soran kişinin kendi bildirdiği veya kendinden bildirilen bir anket formatındadır. Saha araştırmasında, yığın büyüklüğü 400 olan sahadan, rastgele seçilen 206 hemşireden NMQ ile toplanan bölgiler istatistiksel olarak yeterli olmuştur. Araştırma verileri SPSS 26.0 programında analiz edilmiştir. Ankete katılan hemşirelerin %60,7'sinin erkek, %39,3'ünün kadın olduğunu belirlenmiştir. İstatistiksel analizler, herhangi bir yaş grubu ile eğitim düzeyi arasında anlamlı bir ilişki olmadığını göstermiştir. Vücudun herhangi bir bölgesiyle ilgili hemşireler arasında, 12 aylık işe bağlı kas-iskelet prevalansı en yüksek bel bölgesinde (%51.9) olmuş ve bunu boyun (%37.4) izlemiştir. Araştırmanın bulgularına göre, KİSH'ler için ana risk faktörü egzersiz olmuştur. KİSH ile, sigara, egzersiz ve cinsiyet, saat işe, yaş, medeni durum, eğitim düzeyi, çalışma yılı, hastanede çalışılan birim değişkenleri arasında güçlü bir ilişki söz konusu olmuştur ($p \leq 0.05$). Çalışmanın sonuçlarına göre, sadece fiziksel egzersizlerin iş sırasında kas risklerini öngördüğünü ortaya koymuştur (OR=4.366, Cl=1.569-12.15). Bu çalışmadan elde edilen bulgular, bölgedeki hastane yöneticileri tarafından, hastanelerde mesleki riskleri azaltmak ve hasta bakımını iyileştirmek için hemşireler arasında KİSH'nın önlenmesi ve yönetimine yönelik tedavi stratejileri konusunda uygun rehberlik hizmetleri sağlanması amacıyla kullanılabilir olması açısından önem teşkil etmektedir.

2023, 66 sayfa

Anahtar Kelimeler: Sağlık çalışanları, Hemşireler, İşle ilgili kas iskelet hastalıkları, Risk faktörleri, Kas iskelet sistemi hastalıkları.

PREFACE AND ACKNOWLEDGEMENTS

I would like to express my gratitude to God, who can guide me through this stage of the study. I also want to express my sincere appreciation and gratitude to my supervisor, Assoc. Prof. Dr. Semih KUTER, who supported and inspired me to achieve my dream. I would also like to express my gratitude to my family for their love and support.

Zainab Ali Mohammed AMEEN
Çankırı-2023

CONTENTS

INDEX OF ABBREVIATIONS AND SYMBOLS

BMI	Body mass index
DM	Diabetes mellitus
Df	Degree of freedom
EMG	Electron myography
ENMG	Electron euro myography
HT	Hypertension
ISCO	International standard classification of occupations
İBKİSB'ler	İşe bağlı kas-iskelet sistemi bozuklukları
KİSH	İşle ilgili kas-iskelet sistemi rahatsızlıkları
İSG	İş sağlığı ve güvenliği
LBP	Low back pain
LLD	Lower limb disorders
MCV	Nerve conduction velocity
MRI	Mangnetic resonance imaging
MSDs	Musculoskeletal disorder
NCV	Nerve conduction velocity
NIOSH	National institute for occupational safety and health
NMQ	Nordic musculoskeletal questionnaire
OA	Osteoarthritis
OHS	Occupational health and safety
PPE	Personal protective equipment
ULDs	Upper limb disorders
WHO	World health organization
WMD	Work musculoskeletal disorder
WRMSDs	Work-related musculoskeletal disorder

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1. INTRODUCTION

According to the World Health Organization (WHO), "work-related" diseases are multifactorial, meaning that a variety of risk factors, including physical, organizational, psychosocial, individual, and sociocultural factors, play a role in their development. The fact that work-related MSDs are complex is a significant aspect of the debate around them. The main point of contention is the relative weight that various and distinct causes have on the emergence of disease. The same dispute has also had an impact on other medical conditions with numerous occupational and non-occupational causes, such as certain malignancies and lung disorders. Unfavorable working conditions and the absence of a successful program to prevent work-related injuries in most nations have led to a very high prevalence of work-related musculoskeletal disorders (WMSDs) (Holder *et al.* 2009).

Workplace activities like heavy lifting, repetitive motions, and unpleasant working positions are recognized as risk factors for WMSDs; however, demographic features and psychological factors are also proven to be significant predictive variables. Workers may be exposed to WMSD risk factors while doing patient care jobs such as lifting, moving, and giving patients physical therapy. Each action necessitates the use of comparatively substantial amounts of force, and each activity might require the adoption of risky postures. In nurses, WMSD has frequently been linked to patient handling, and biomechanical tests have found incredibly high related loads. Nursing professionals are among those at the highest risk of non-fatal occupational musculoskeletal injuries (Hoskins, 2004). These injuries frequently result in temporary or permanent occupational difficulties and typically affect the superior limbs, the scapular region around the shoulder, and the cervical region.

However, they can also impact the inferior limbs. The severe use of the musculoskeletal system and its poor recuperation result in injuries from work-related musculoskeletal illnesses, which include clinical problems. When employees are subjected to subpar

working conditions, they become victims. For several healthcare professions, the risk of musculoskeletal illnesses related to their jobs is significant (Harcombe *et al.* 2014).

Numerous studies that have linked stressful work postures to functional disruption or discomfort in various musculoskeletal system locations have established the need to change working posture. If no proactive steps are taken to identify and resolve the problem, ineffective postures will continue to have an effect. Better working positions may assist employees' musculoskeletal systems, which may also result in improved performance management and a decrease in occupational injuries (Trinkoff *et al.* 2009).

WMSDs are problems with the muscles, tendons, nerves, ligaments, fascia, and synovial membranes (joint tissue), with or without tissue deterioration. They are diagnosed based on the presence or absence of symptoms such as discomfort, numbness, a heavy feeling, and weariness (Bernard et al. 1997). WMSDs, which are brought on by repetitive or frequent work activities or activities requiring uncomfortable postures, impact the tendons, muscles, joints, peripheral nerves, intervertebral discs, and vascular system. WMSDs in the nursing field are brought on by repetitive movements, prolonged awkward postures, hereditary predisposition, and length of practice (Aptel *et al.* 2002).

It is generally known that WMSDs have a significant role in causing severe human suffering and loss of productivity in a number of industries. WMSDs can also be uncomfortable, make it difficult to complete chores, and require time off from work. High medical costs, negative effects on everyday life, low job performance, the economic repercussions of working fewer hours, and early retirement from the field are a few others (Smith *et al.* 2003, Leijon *et al.* 2009, Holder *et al.* 2009).

Physically and emotionally, the nursing profession is a difficult one. Because the equipment used in the chosen hospitals is not ergonomically designed, nurses are subjected to uncomfortable working conditions, such as tense posture, which can lead to physical problems including backaches and other aches and pains. The issue is complicated and expensive; it has a detrimental effect on nurses' quality of life and has

financial repercussions in the form of medical expenses, the potential for lost workdays, and subpar performance at work. Given that nurses work long hours performing repetitive duties, inadequate staffing may possibly are a contributing cause to the high prevalence of WMSDs in this population. Nursing tasks frequently involve lifting heavy objects, moving patients, working in uncomfortable positions, and transporting patients from the floor to beds. Nurses are at greater risk of both acute and accumulative WRMSDS due to these occupational demands (Dizdar 2008, Dizdar 2014).

1.1 Objectives of the study

The primary goal of this study is to look into early detection of work-related musculoskeletal illnesses among nurses at the Hilla Teaching Hospital in Babil, Iraq. The particular goals are to:

- Raise nurses' knowledge of work-related musculoskeletal disorder.
- Identify risk factors that may contribute to the development of such WMSDs in nurses.
- To what extent do work-related musculoskeletal problems affect nurses' productivity.

2. GENERAL INFORMATION

1.2 Occupational health and safety

The idea of workplace health is to prevent employees from becoming ill as a result of their surroundings and working conditions. Using techniques to reduce these risks, occupational safety is the process of shielding workers from the risks brought on by the usage and presence of a variety of tools, equipment, and materials in the workplace (Dizdar 2000, Dizdar 2003, Aydın 2016).

Workplace health, safety, and welfare are covered under OHS, which serves as a foundation for reducing occupational accidents to an acceptable level. OHS is concerned with the health, safety, and welfare of workers in a variety of industries (Victorian Auditor General's Report 2013).

The healthcare sector, which is among those most negatively impacted by inadequate OHS management, strives to raise health and safety standards in medical facilities around the world. There are numerous special risks in hospitals that may have an impact on the health of staff in all of their departments (Dizdar 2003, Gorman *et al.* 2013).

These risks lead to more workplace accidents, which negatively affect patient and medical staff security and reduce productivity and performance. The field of health services is one of the industries that is highly valued in terms of occupational safety and health. Due to the variety of working situations, there are many distinct types of danger (especially in hospitals) (Dindar *et al.* 2004, Dizdar 2020).

According to the report, there are over 1000 potential health hazards at a normal hospital, including medications, infections, fires, natural disasters, poorly built workspaces, etc. (Kavuncabaşı and Yıldırım 2000). Hence, when we attempt to define the atmosphere of a safe and healthy hospital, we discover that the National Institute for Occupational Safety and Health (NIOSH) offered the initial definition in 1977.

According to this definition, a healthy and safe hospital environment is one in which there are no occupational illnesses or accidents connected to risks and dangers brought on by mechanical, ergonomic, chemical, or biological failures while work is being done. Hospital staff members who have acquired (or are currently acquiring) medical education are aware of the hazards that could result in health issues for them while providing medical services (Aksay 2015).

Since nurses make up the largest group of hospital employees, they face the greatest risks and difficulties, including long working hours, an excessive or heavy workload, time constraints, challenging or complicated tasks, caring for patients with life-threatening illnesses, insufficient breaks, monotonous and unfavorable working conditions, etc (Alçelik *et al*. 2005).

Inadequacies in the healthcare system and an uneven allocation of people also lead to nurses' disillusionment and stress (Öztürk *et al*. 2012). They claimed that pressure and stress at work, long hours, and excessive overtime are all strongly related to safety. According to all of these findings, nurses' occupational safety and health are seriously at risk. Also, numerous studies show that nurses experience a variety of mechanical, physical, chemical, biological, psychological, and occupational injuries and illnesses (Öztürk *et al.* 2012, Dindar *et al*. 2004).

Occupational illnesses and accidents result in a loss of labor force, decreased productivity, and an increase in hospital expenses. Thus, it has been suggested that extensive research be done to determine the causes and hazards of occupational accidents and diseases, as well as the best ways to safeguard nurses from these risks (Bahcecik and Ozturk 2009).

1.2.1 Goals of the occupational safety and health

The following are the broad goals of the occupational safety and health program in hospitals (Dizdar 2000, Dizdar 2003):

- Assessment and investigation of workplace risk factors in hospitals.
- Each function must adhere to fire safety regulations.
- Create a safety strategy for hospitals based on the findings of the evaluation and risk analysis to maintain worker occupational safety.
- System evaluation and inspection for occupational safety and health.
- Safeguarding radiation rooms and taking precautions.
- Dealing with garbage and medical waste quickly and conveniently and understanding hospital public health systems.
- Ensuring safety measures and personal protective equipment (PPE).

Due to the risks that may befall them, there are additional standards that must be adhered to or offered to all employees in the field of hospitals or health facilities. These requirements are standards for hospital and health center employees' safety:

- Doing a medical exam when starting employment and ongoing periodic exams,
- Adherence to all workplace occupational safety regulations established by the administration,
- Use personal safety gear when working,
- Implementing health and safety precautions (established by the hospital administration and the competent authorities),
- A commitment to keeping a work safety record that includes all incidents and accidents (OSHPHI 2018).

1.2.2 The occupational safety and health in health facilities

There are many benefits to applying the occupational safety of health facilities, including (Al Maghamsi 2020):

- Using the occupational safety and health management system in healthcare institutions has numerous advantages, including achieving conformity with occupational safety and health-related laws, regulations, and legislation,

- Creating a secure working environment that lowers the number of mishaps, illnesses, and injuries at work, whether they affect employees, patients, or visitors,
- Making sure that healthcare facilities continue to operate and continue to offer essential medical services,
- Lowering the financial burden of accident-related expenses, compensation, and insurance obligations,
- Increasing output quality, boosting employee morale, and boosting trust in hospital administration,
- Strengthening the culture of occupational safety and health among employees to deliver high–quality services that uphold patients' safety while maintaining their own,
- Integration of needs and resources to implement the highest levels of occupational safety and health among all relevant departments,
- The existence of a system of monitoring, auditing, and follow-up to make sure that goals are met and performance effectiveness indicators are met in a coordinated and efficient manner,
- Increasing patient happiness and self-assurance while enhancing the reputation of the medical facility and public trust in it.

1.2.3 Hospitals

The quality of the country's healthcare system is one of the most crucial measures of its degree of development. The institutions and organizations that provide these services play crucial roles in the attainment of the health services they provide and the condition of enjoyment of health, which is the obligation of health. The term "health services" refers to all actions taken to diagnose, treat, and rehabilitate patients, as well as to prevent disease and raise both societal and individual health standards. Preventive health services, treatment services, rehabilitation services, and health promotion services are some of the four basic categories under which health services are categorized (Şahin 2014).

Making sure that individuals continue to live healthy lives is crucial to classification. One of the key responsibilities of the state is to provide preventive, curative, and preventive health services to its residents in order to increase the amount of time that people spend in a healthy fashion. This is a requirement of the social state principle. There are various categories for health services. Hospitals are further divided into categories based on ownership, educational status, service type, size, patient stay time, accreditation, and level of service. Patients will now be able to select hospitals based on whether or not they are accredited. They will make it possible for businesses to compete with one another in this instance (Şahin 2014).

1.2.4 Health workers

Physicians, nurses, midwives, public health professionals, laboratory technicians, health, medical, and non-medical technicians, personal care providers, community health workers, traditional healers, and practitioners of traditional medicine are all considered to be health workers. According to the International Standard Classification of Occupations (ISCO), health workers also include people who work in the administration and support of healthcare, including cleaners, drivers, hospital administrators, district health managers, social workers, and other occupational groups involved in healthcare-related activities. An efficient healthcare system is built on the labor of health professionals. In order to maintain their health, health workers should also have the right to work in safe and healthy environments. Health workers help to ensure that everyone has the right to health (WHO, 2022).

Infections, poor patient care, toxic chemicals, radiation, heat, noise, psychosocial risks, violence, harassment, injuries, and a lack of access to appropriate water, sanitation, and hygiene services are just a few of the occupational dangers that health workers are exposed to. The primary goal of the health sector should be to safeguard and restore health without putting patients or health professionals at risk. This includes protecting their health and safety. In addition to enhancing the quality and safety of care, human resources for health, and environmental sustainability in the health sector, maintaining

the health, safety, and well-being of health professionals minimizes work-related sickness and injury (WHO 2022).

1.2.5 Hospital Workers, Patients and Visitors are exposed to Various Risks

The risks to which hospital staff, patients and visitors are exposed are listed below (Al Maghamsi, 2020):

- Chemical risks: There are numerous harmful chemicals, including those in sanitizers, cleaning products, medicines, and solutions. According to the chemical safety bulletin, if these products are not handled according to regional laws, global standards, and manufacturer-approved procedures, they can result in serious dangers.
- Physical dangers include things like noise, lighting intensity, radiation, and ventilation. This necessitates attention to recognizing, assessing, and making an appropriate evaluation for them, as these risks can result in numerous occupational disorders, which frequently manifest after a period of continuous exposure to them.
- Hazards associated with human factors engineering (ergonomics) include repetitive motions, patient lifting and movement, hospital beds, doctor chairs, and staff offices, which can result in back, neck, and joint pain.
- Biological hazards include things like germs, viruses, fungi, parasites, medical waste, tissue leftovers, and blood residues. These things can lead to illnesses like hepatitis, AIDS, and many other conditions. This is one of the most significant concerns that affect healthcare facilities more frequently than other types of facilities.
- Fire risks, particularly those related to electrical, medical, and cooking equipment to provide the highest levels of engineering design.
- Psychological and social dangers include stress, lack of sleep, workplace aggression, drug usage, depression, sexual harassment, poor attitudes, and inappropriate behavior, particularly during times of emergency, such as wars, diseases, and fatalities, as well as when working long hours. Implementing a thorough and proactive occupational health and safety management system is one of the most efficient strategies to reduce and control hazards and injuries in the workplace. An occupational safety and health management system that complies with international standards, like the international standard for safety and health management, which integrates occupational safety and health into every work performed in healthcare institutions, is a proactive approach to

identifying and managing workplace risks before they cause harm to employees, patients, or visitors.

1.3 Musculoskeletal disorders in ergonomics

1.3.1 Ergonomics

Ergonomics, the scientific field of ergonomics, seeks knowledge and theories that might enhance human well-being, happiness, and overall system performance. It also applies appropriate methodologies and analyzes how people and other system components interact with one another. Ergonomic refers to all applications that seek to make all types of design, working, and living circumstances more humane (Dizdar 2014, Gün 2017, Dizdar 2020).

These applications are intended to create a healthy working environment, eliminate hazards, control working hours in accordance with physiological features, and adjust tools and equipment to the task at hand and the user (Gün 2017). In addition to interacting with tools and their surroundings, healthcare providers also engage with patients. Because of this, ergonomics in healthcare facilities looks at the interactions between the patient, the machine, and the environment, as well as between the staff, the machine, and the environment (Babayiğit and Kurt 2013, Güler *et al.* 2015).

It also looks at the interactions between the staff, the machine, and the environment. In order for nurses to stay healthy and attend to the needs of patients with various issues, ergonomic principles should be implemented in settings where healthcare services are delivered (Babayiğit and Kurt 2013, Güler *et al.* 2015). Healthcare professionals' likelihood of experiencing occupational dangers varies depending on the department they work in, their profession, and the tasks included in their job description and performed frequently in practice (Reilly 2002, Parlar 2008).

Since nurses spend the majority of their time with patients and provide direct treatment, the likelihood of running into health dangers is very high. Numerous dangers are

associated with the nursing profession, including prolonged labor in a stressful atmosphere, an excessive workload, deadline pressure, challenging or complex duties, a lack of breaks for relaxation, uniformity, and unhealthy working conditions (temperature, posture, and lighting) (Reilly 2002, Parlar 2008).

Enhancing the productivity, job satisfaction, and retention of health professionals is made possible by protecting their health and safety. Taking into account the unique working conditions and occupational dangers in the health sector, it also makes it easier for medical institutions to comply with national laws and regulations on occupational health and safety. The health sector incurs enormous financial expenditures as a result of unsafe working conditions that result in occupational illnesses, accidents, and absenteeism (WHO 2022).

For instance, the healthcare and social services industries in Great Britain had the highest yearly expenses for occupational disease and injury in 2017, with an estimated $3.38 billion. A reduction in occupational injury costs (estimated at 2% of health spending) and a reduction in patient harm (up to 12% of health expenditures) can be achieved globally by enhancing the health, safety, and well-being of health workers (WHO 2022).

1.3.2 Musculoskeletal disorders

Muscle skeletal, also called the striated muscle: The majority of the human body's muscles are found there, which serves as the body's principal engine. There are around 475 distinct skeletal muscles in the body, and they make up about 40% of the body's weight. Skeletal muscles move and regulate the position of the skeleton's bones. Each muscle has two basic parts: the origin and the implant, which are separated according to where they attach to the bone. Tendons connect muscles to bones. The location on the bone adjacent to the origin of the bone where the muscle's end is attached is called the origin. The location where the muscle is linked to the bone's most stable portion is another way to describe the muscle's genesis. When it comes to muscle implantation, it refers to the location where the muscle is joined to the most movable portion of the

bone or where the distal end of the muscle attaches to the bone. When a bone and a muscle are joined by a joint that may move, the muscle contraction will cause the joint to move (extensor). An antagonistic pair of muscles is responsible for controlling most joints (Hinnawi 1987).

Musculoskeletal diseases are the most prevalent occupational diseases among healthcare professionals and are related to the musculoskeletal system. It is risky for the sickness to be registered, even though it is widespread. There are challenges. Healthcare personnel frequently suffer from foot issues, varicose veins, wrist abnormalities, and muscular conditions like lumbar back pain. Occupational illnesses connected to the skeleton. Lifting-related back discomfort is one of the most prevalent illnesses. The most prevalent symptom of the majority of musculoskeletal problems is pain. Pain can be localized or diffuse, and its intensity can range from mild to severe. It can also be acute, short-lived, or chronic. Illnesses of the bones, joints, muscles, tendons, ligaments, bursae, or a combination of these illnesses may be the source of musculoskeletal discomfort. The most common source of discomfort is injury (Şahin 2014).

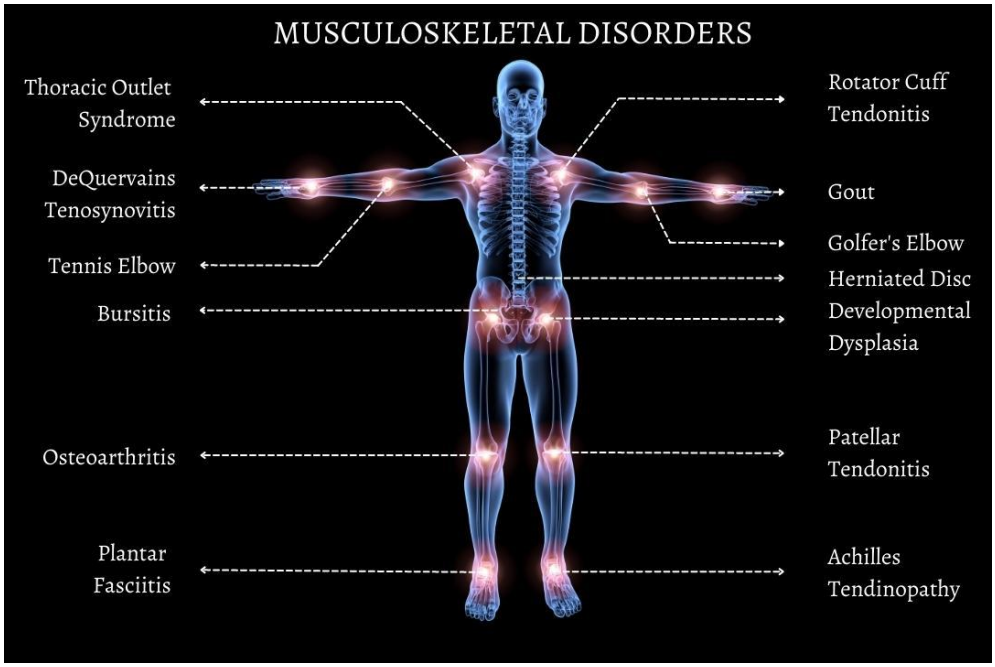


Figure 1.2. Types of musculoskeletal disorders throughout the body (Medlegel 2023).

1.4 Classification of WMSDS for nurses

1.4.1 Low back pain

In hospitals, there are a variety of job settings that could cause low back pain (LBP). There is more backache in occupations that require severe manual labor, difficult manual labor, repetitive work, and extended periods of sitting if the workspace is not set up or adjusted to fit the person, improper posture, exerting excessive effort when pushing, pulling, or dragging loads, and going beyond one's usual capabilities and limits. Back discomfort frequently lacks a known cause. Acute and chronic LBP are also possible. Following a hefty lift, a rapid movement, or hunching over, acute occupational LBP is frequently noticed immediately.

The discomfort could not be severe, or it might be crippling. Chronic occupational LBP emerges over time. Doing physically taxing activities for an extended period, such as awkward postures or manual labor, might cause it. Chronic occupational LBP, also referred to as a herniated disk in medicine, can result from repetitive manual labor, such as extended periods of standing or sitting in uncomfortable positions, combined with patient lifting and support. Sharp pain and numbness in one area of the leg, hip, or buttocks are signs of a herniated disk (Wami *et al.* 2019).

1.4.2 Neck and upper limb problems caused by work

There is a ton of material on LBP among healthcare professionals, but very little on occupational cervical-brachial issues or pain in the neck, shoulder, or arm. Being around patients can put unnecessary strain on the neck, shoulders, and arms, which can lead to LBP as well as discomfort in those areas. Neck and shoulder pain is a common complaint among nurses, especially those who perform tasks that require reaching, pushing, and tugging (Smedley *et al.* 2003). Repetitive movements, uncomfortable postures, constant or excessive force, the extended performance of professional

activities, a disorganized work environment, individual differences, and vulnerability are the causes of upper limb diseases (ULDs) (Ando *et al.* 2000).

Tension neck syndrome: Any of the neck's structures can experience pain. Along with the spinal vertebrae and the discs that sit between them, these also include muscles and nerves. In addition to the neck, other areas that can experience neck pain include the shoulder, jaw, head, and upper arms. If the neck pain is caused by a nerve, it may cause numbness, tingling, or weakness in the arm, hand, or other areas. Serious muscular spasms, for example, can be brought on by a pinched nerve or a slipped disk pressing on a nerve. Neck pain frequently results from tension or strain in the muscles. For healthcare workers, prolonged awkward postures like hunching over a desk for hours or positioning a computer monitor too high or low are the main occupational risk factors for tension neck syndrome (Tezel 2005).

Spondylosis of the cervical spine: The cartilage and bones in the neck exhibit aberrant wear in cervical spondylosis (cervical vertebrae). Chronic degeneration of the cervical spine, especially the cervical disks that cushion the joints linking the cervical spine's bones and the neck vertebrae, is the root cause of cervical spondylosis. Manual handling and protracted, unpleasant posture are the main occupational risk factors. The primary warning signs and symptoms include neck discomfort, especially at the back of the head; arm weakness; loss of feeling in the arms or shoulders; progressively worsening neck stiffness; and strange feelings or loss of feeling in the arms or shoulders (Mahbub 2006).

Shoulder tendinitis can have two different types: Biceps tendinitis is the cause of a shoulder ache on the front or side, which might reach the forearm and elbow. If the arm is raised above the head, the discomfort may also get worse. The discomfort may become worse when reaching, pressing, tugging, lifting, elevating the arm over shoulder height, or sleeping on the affected side. a case of impingement syndrome The main occupational risk factors for various forms of tendonitis in healthcare workers include continuous arm hyperextension, repetitive wrist and shoulder motions, and a high load

on the shoulders. Tendonitis symptoms include pain, numbness, weakness, swelling, a burning feeling, or a constant ache surrounding the injured area (Dhillon 2019).

Syndome of the thoracic outlet: A weak grip, tingling and numbness in the fingers, and pain in the neck and shoulder are all symptoms of thoracic outlet syndrome. Blood vessels and nerves may not have adequate room to flow through or next to the collarbone and upper ribs. Symptoms in the arms or hands could be brought on by compression on these blood vessels or nerves. In almost all situations, thoracic outlet syndrome is caused by problems with the nerves. Compression can be caused by either an extra cervical rib (above the first rib) or an abnormally tight band connecting the spinal vertebra to the rib. The two main job dangers for healthcare workers that cause thoracic outlet syndrome are lifting the arms above shoulder level and extended shoulder flexion. Ring and little fingers, the inner forearm, tingling in the neck, soreness in the shoulders (lifting large objects could exacerbate the discomfort), and The main symptoms of the disorder are indications of insufficient blood flow in the hand or forearm (bluish tint, cold hands, or a swollen arm) (Brooke and Freischlag 2010).

The shoulder joint capsule houses the ligaments that attach the shoulder bones to one another. The shoulder bones cannot freely move inside the joint when the capsule is inflamed. Long periods of uncomfortable posture and manual handling are the main occupational hazards that lead to frozen shoulder syndrome in healthcare workers. The shoulder's reduced range of motion, discomfort, and stiffness are the syndrome's main symptoms. Shoulder capsulitis, often known as frozen shoulder, always begins with excruciating discomfort that limits arm movement. The lack of motion causes stiffness, which eventually results in even less movement. Those who have frozen shoulders eventually find it difficult to reach over or behind their heads (Robinson *et al.* 2003).

The disease of de Quervain illness arises when the tendons close to the base of the thumb become inflamed or squeezed. Thickened tendons may cause discomfort and irritation along the wrist's thumb side. The tendons can move through the tube with ease thanks to synovia. These nerves may become compressed if any tendons next to them swell. This may result in numbness in the fingers or pain in the wrist. Repetitive hand

twisting and tight grasping are the main occupational hazards that contribute to De Quervain's disease in healthcare workers. It could hurt on the wrist's thumb side; there may be swelling there and possible numbness in the thumb and index finger. These are the main symptoms of this condition (Lelis *et al*. 2012) :

Palmar-plantar syndrome: When the median nerve at the wrist is pinched or compressed, palmar-plantar syndrome results. The midline nerve and tendons are housed in the wrist numbness. The midline nerve can occasionally get crushed due to the tunnel becoming thicker as a result of swollen tendons or other swellings that make the tunnel smaller. The main symptoms include discomfort that frequently first manifests in the hand during the night and numbness or weakness that travels up the arm and into the hand. The palm and the fingers, particularly the thumb and the index and middle fingers, frequently experience burning, tingling, or itching as symptoms. It could be challenging to make a fist, hold little things, or carry out other manual duties if your grip strength is declining. The muscles near the base of the thumb may atrophy in persistent or untreated cases. Hand and wrist movements that are vigorous while working and repeated wrist motions from using a computer are the main occupational risk factors for healthcare professionals developing the syndrome (Anton *et al.* 2002).

1.4.3 Lower limb musculoskeletal disorders

Many industries experience lower-limb musculoskeletal ailments and injuries, especially knee problems, which frequently coexist with conditions in other body regions. Workers may sustain both acute and overuse injuries, although overuse injuries are more frequent. The LLD most frequently cited as being connected to the workplace is osteoarthritis of the hip (OA), knee, bursitis, lesions or damage to the meniscus, venous diseases, and stress fractures. Occupationally derived LLD has negative repercussions on society, the economy, and industry in the form of lost productivity, hospitalization, medical care, a reduction in job capacity, and a reduction in quality of life. The specific impact depends on the state and the number of damaged joints (Jensen and Dahl 2005).

Hip and thigh problems related to osteoarthritis (OA) have received a lot of attention in research on hip disorders related to the workplace, and it appears to affect men more frequently than women (Cooper *et al.* 1998). As the cartilage covering at the end of a bone becomes worn down and destroyed, it can cause OA, a disorder that affects the body's joints (such as the knees, hips, and spine) (Whiting and Zernicke 1998). Other underlying medical disorders, albeit less frequently reported, such as Piriformis syndrome, trotrochanters, and sacroiliac pain among the dental professionals in their study population have been mentioned in addition to hip OA. The term "piriformis" refers to a disorder in which the piriformis muscle irritates the sciatic nerve, resulting in discomfort that radiates down the length of the sciatic nerve and into the buttocks. Similar to lateral hip discomfort, trochanteric syndrome results in palpable tenderness of the trochanter major and can occasionally radiate distally. Pain that is concentrated in the lower part of the back and hip is a common description of sacroiliac discomfort. In some situations, it may migrate down the legs or around to the front, in the groin area, and it may even radiate out to the buttocks and lower back. These findings show that only a small number of hip issues are related to the workplace (Akesson *et al.* 1999).

Knee conditions Similar to the hip, OA has been the subject of several studies on problems with the knee related to labor. Bursitis, hyperkeratosis of the knee, and meniscal lesions or damage are some more disorders that have been linked to the workplace. The most often studied knee injury condition after OA is bursitis. Coal miners' knees, carpet layers' knees, or housemaids' knees are frequent names for it since these professions historically have involved employees performing knee-straining activities (Forde *et al.* 2005).

Typically, prolonged kneeling causes frictional tension to build up directly over the knee bursae, which results in bursitis. A different type, known as pyogenic bursitis, arises from a skin injury that penetrates the surface. Most frequently, bursitis affects the big prepatellar bursa, which is located between the patella and the skin. Bursae are tiny, fluid-filled sacs that surround tendons, bones, and muscles. Their purpose is to provide cushioning for the action between the bones, tendons, and muscles close to the joints so that the joints can move more easily and without causing pain. When a worker gets

bursitis, they typically present with discomfort, edema, and a restricted range of motion in their knees because of pain and tightening of the skin above the patella (Forde *et al*. 2005).

Hyperkeratosis, formerly known as "Beat Knee," is the thickening of the skin as a result of pressure. It is a severe and acute form of bursitis that frequently affects people whose jobs require knee-straining movements like bending and squatting. Long-term kneeling frequently causes hyperkeratosis, which can cause persistent pain. Meniscal injury or lesions When the knee is subjected to high rates of force or significant rotational force, such as when it is bent or twisted while supporting weight, meniscal lesions are typically damaged. Some sports, like football and handball, are believed to cause acute illnesses to happen more frequently (Jensen *et al.* 2000).

Lower leg conditions, strain fractures and stress reactions: The phrase "stress reaction" refers to bones that have remodeling signs but no radiological signs of fracture. In reality, the physiological adaptation of the bone to mechanical stimulus is what causes the stress reaction and consequent stress fracture (Whiting and Zernicke 1998). When a bone's maximal strength is surpassed by an applied force (such as that experienced while marching or foot-stomping) and the normal mechanism by which bone adapts to stress is inhibited, stress reaction fracture results.

Those undergoing military training and athletes, particularly long-distance runners, are more likely to experience it, and research concentrating on these populations has provided a lot of knowledge. There was only one study that connected the illness to occupational workers (Jensen and Dahl 2005). They presented the case of a 59-year-old male welder who presented with a stress fracture to the left distal tibia and fibula as a result of heavy lifting at work. They noted that cases of stress fractures of the tibia and fibula have previously been documented in ballet dancers. While the fibula tends to play a minimal role during axial loading of the limb, stress fractures in the lower leg are typically connected with the tibia rather than the fibula (Jensen and Dahl 2005).

Varicose veins: The medical staff develops varicose veins from prolonged, uncomfortable postures when standing and walking for very long periods. Working in an uncomfortable, prolonged standing position damages the veins' valves, causing blood to build up inside the vein and resulting in swollen, distorted, and even painful veins that are overflowing with blood. As a result, as the blood pools, the veins will grow larger. Typically, this process takes place in the legs' veins. Most often affecting women, varicose veins are widespread.

In addition to obvious, swollen veins, modest ankle swelling, a dark discoloration of the skin at the ankles, and skin ulcers close to the ankle, the signs include heaviness, fullness, soreness, and even leg pain (Krijnen *et al.* 1997). The legs may swell without any pain due to gravity, and lower body swelling is particularly noticeable. For health care professionals, prolonged stances (like performing surgery) or sitting (such as the work of odontologists and laboratory personnel) are common causes of foot, leg, and ankle edema. Many ankle and foot disorders, including sprained ankles, anterior compartment syndrome, plantar fasciitis, Achilles tendonitis, foot corns, and Halux valgus (bunions), have been documented; however, it is still unclear how many of these conditions are related to the workplace. For instance, the etiology of foot and ankle illnesses such as hallux valgus, interdigital neuroma, tarsal tunnel syndrome, smaller toe deformity, heel discomfort, adult-acquired flatfoot, and foot and ankle OA was rigorously evaluated in the literature (Guyton *et al*. 2000).

1.5 Symptom of WMSDs

Pain is by far the most common WMSD symptom. On occasion, there may be joint stiffness and muscle and joint tightness, and there may be redness and swelling. Moreover, some workers may experience numbness, "pins and needles," changes in the color of their skin, and a lack of hand sweat. The WMSDs can range in intensity from mild to severe. Throughout the working day, the affected limb is worn out and achy but feels better at night and on days off. Work performance is unaffected when these symptoms start to manifest in the early stages. The capacity to perform repetitive tasks

is reduced in the intermediate stage by aches and exhaustion that begin early in the workday and linger through the night (Silverstein *et al*. 2010).

At the final stage, it becomes challenging to get any sleep or do simple tasks because of pain, exhaustion, and weakness that persist even when at rest. Not everyone goes through these stages in the same way (Tinubu et al. 2010). In fact, it could be difficult to say with absolute certainty when one stage ends and the next one begins. While the pain is at its mildest, the muscles and tendons should rest and recover. Without treatment, a wound could swell up and eventually become irreparable. The sooner signs are detected, the quicker people should respond to them (Silverstein *et al*. 2010).

1.6 Musculoskeletal disorders risk factors

Science has established the significance of physical and mental aspects associated with employment in shaping the musculoskeletal system. Other factors than workplace activities affect the development of these diseases. Workplace risk factors, psychosocial risk factors, and individual risk factors make up the three categories of risk factors for musculoskeletal disorders (Silverstein and Clark, 2004). Workplace risk factors and musculoskeletal disease symptoms and signs: One of the risk factors for musculoskeletal issues is work-related stress. Frequent seizures, a long day at work, positions that are static and unmoving, the absence of lifting tools, handling patients manually (push, pull, carry), working the arms above shoulder level for long periods of time, using computers more frequently, and issues with ergonomics (the most prevalent symptoms of these issues were pain, joint stiffness, edema, redness, and muscular tension; occasionally, numbness, tingling, perspiration, and changes in skin color were also seen) (Silverstein and Clark 2004).

Psychosocial Predisposing Variables for Musculoskeletal Diseases: The following are psycho-social risk factors for musculoskeletal illnesses: burden and accountability job discontent due to uncontrollable features of the job and a lack of collaboration on the part of the boss.

Individual Risk Factors for Musculoskeletal Diseases: Some of the personal risk factors for musculoskeletal illnesses include the ones listed below: Obesity advances with age. Conditions that coexist (HT, DM, rheumatic, and orthopedic diseases): insufficient fitness, smoking, and gender.

1.7 Techniques for Diagnosis WMSD and Therapy

The WMSD assessment looks at occupational risks. The process of evaluation begins with a discussion about the subject's line of work and necessitates a detailed explanation of all the actions that constitute an average workday. Every task completed at work, including its frequency, intensity, length, and regularity, is taken into consideration (Varmazyar et al. 2009). WMSDs can be accurately identified through technical and laboratory testing to detect nerve or muscle injuries. These examinations include electromyography (EMG), one of which is electroneuromyography (ENMG), and nerve conduction velocity (NCV). As an alternative to x-rays, magnetic resonance imaging (MRI) produces images of tendons, ligaments, and muscles and increases the accuracy of the diagnostic data (Trinkoff et al. 2002).

WMSDs can be treated in a variety of ways, including immobilization, application of heat or cold, exercise, medication, and surgery. Avoiding the actions that caused the harm is the first step in reducing WMSDs; this may lead to therapy. This often necessitates work limits, and in some circumstances, a job change should be considered. A splint can also make the damaged joint immobile or restrict its range of motion. Splints should only be used in work settings with the utmost caution. Splints can do more harm than good if applied improperly.

Splints are routinely used to mechanically support joints when it is predicted that they will be subjected to an excessive load and to prevent the injured joint from moving. Splints shouldn't be employed as mechanical support for the joint in a work environment. To avoid early, excessive pressure on the worker's joints, the task needs to be modified. It is necessary to cease or alter the work activity that resulted in the injury to successfully use splints to immobilize an injured joint. There is a danger that the

worker will hurt other joints while trying to make up for the splinted one if unsafe working conditions are maintained (Vingard 2006). Applying heat or cold has the potential to reduce discomfort and has been shown to hasten the healing process. For the pain management of small injuries, it is advised to use heat. For wounds with considerable edema and inflammation, it is not advised. Heat causes edema and also promotes blood flow, which lessens pain and swelling. Stretching provides additional advantages in addition to improving circulation and alleviating muscular stress.

Hence, before engaging in physical activity, people with WMSDs should speak with a physiotherapist. If stretching or exercise programs are not organized properly, they may make the situation worse. The use of anti-inflammatory medications, which may lessen pain and inflammation, is the final line of defense against WMSDs. If all other treatments fail, the doctor might try a more complex therapy or perhaps surgery (Trinkoff *et al*. 2009).

1.8 Consequences of Occupational Musculoskeletal Diseases

The condition has a substantial negative impact on job satisfaction and motivation, results in lost workdays, and can have negative repercussions like leaving the profession for nurses who experience any WMD problems as a result of overload. The average number of days that cannot be attended in circumstances that result in dismissal from work due to occupational WMD problems is stated to be seven (Kelsey 2007).

This information was gleaned from studies on the loss of working days, which is one of the effects of occupational WMD problems. Other research on the same topic shows that patient transfer practices are used by caregivers with occupational WMD problems, which can lead to overwork. As a result, it was discovered that they preferred to work in units where they would exert less physical effort and either changed positions or left the nursing profession (Sjostrom *et al.* 2010).

At least 12% of nurses left their jobs as a result of WMD issues. nurses who had left the field, and 38% of the respondents said that occupational WMD disease was the cause of their departure. Low back pain was cited by 12% of nurses who were considering leaving the field as the most significant and precipitating factor (Owen 2000).

This study was also conducted in England. The risk of injury from repetitive pushing, pulling, and turning movements as a result of long working years and having prior WMD injuries was cited as a reason for early retirement in a study looking at nurses working in bedside carer positions (Sjostrom *et al.* 2010).

Nurses frequently experience burnout, which is a significant contributor to nurses leaving the field or retiring early. It can come from high levels of stress in the workplace and can be categorized under the following three categories: emotional weariness, depersonalization, and lack of personal success. While it is believed that having an occupational WMD disease can cause feelings of burnout, it is also suggested that working under physical and mental stress and feeling burned out are directly associated with occupational WMD diseases (Owen 2000).

1.9 Prevention of WMSDs

Preventing MSDs among hospital workers Lowering physical demands, better work organization, staff training, medical care, rehabilitation, and return-to-work strategies are just a few of the strategies used to avoid MSD disability (Podniece 2008). When considering preventive measures, both organizationally and personally, attitudes and points of view toward ergonomics in the hospital work environment must change (Waters *et al*. 2006).

Mechanical devices and ancillary equipment: The tools and aids people choose from the mechanical world have an impact on how they handle tasks. Today, a wide variety of mechanical devices are available that are designed to ease the physical strain of the task at hand or to assist with patient management. Mechanical devices, such as lifters, bath

or hygiene chairs, and car lifts, minimize the need for manual transfers in a hospital setting and assist patients with daily tasks (Waters *et al*.2010).

A few items that can be utilized to lower the dangers involved with patient handling include handling slings, lifting sheets, sliding boards, stretchers, lifting belts, lifting frames, turntables, trapeze/monkey rings, and grip bars (Waters *et al*.2010).

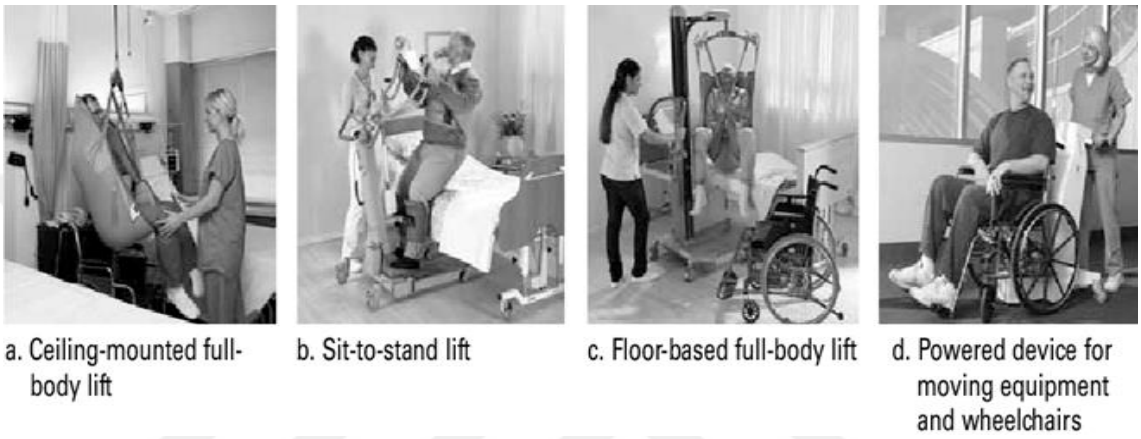


Figure 1.2. The items that can be utilized to lower the dangers involved with patient handling (Water *et al*. 2010)

The organizational level of MSD prevention in hospitals includes assessing workplace risks, implementing technical interventions (workplace design, ergonomic tools and equipment, and protective gear), training healthcare personnel, and developing return-to-work plans. Hospital ergonomics can be assessed at work to assist employers in modifying the workspace. The surfaces on which patients are handled in work areas must be steady, slip-resistant, and even. When floor coverings are improperly installed or allowed to decay, floors may become uneven. Where possible, all equipment, including beds, chairs, and baths, should have adjustable working heights. Extremes in temperature, humidity, or air movement can cause symptoms like weariness, drowsiness, or lack of sensation, all of which could make it challenging to complete a task. It's important to install and maintain good lighting (Waters *et al.* 2006, Waters *et al.* 2010).

The workload should be organized to a minimum, patients should be handled manually, and the workers should have adequate time to relax and recover. In order to reduce repetitive or prolonged work, there should also be furniture and equipment that efficiently decrease handling operations, distribute handling tasks uniformly throughout the shift, and rotate people who do handling operations. It is beneficial to take several quick breaks throughout work times that require a lot of repetition as opposed to one long break at lunch (Waters *et al*. 2006, Waters *et al.* 2010).

Healthcare staff need to have the appropriate training before engaging in any patient handling activity. Employees who feel uncomfortable or have other symptoms that may be related to treating patients manually should consult with an occupational health physician as soon as possible to assess their health issues and create a rehabilitation plan (Waters *et al.* 2006, Waters *et al.* 2010). Individual level every healthcare professional should determine their unique, best working posture. Workplaces and tools should be designed to accommodate employees of different shapes, sizes, and physical abilities, including, for instance, left-handed employees. It is advised to have access to platforms, adjustable chairs, footrests, and tools with grips of various sizes (Waters *et al.* 2006, Waters *et al.* 2010).

Every member of the team should feel at ease with the workspace's location, height, and design. By sliding rather than lifting, each healthcare professional can reduce their own use of force. They should also check that all handles are in good shape and easy to use without excessive force. Hospital staff members should be taught how to complete tasks more efficiently by using the right instruments and equipment in place of physical labor. Employees should have this equipment, but they also need to be properly trained on how to use it (Waters *et al.* 2010).

As a backup strategy, natural ventilation must be taken into account. Thermal comfort for workers should be offered in accordance with seasonal conditions. There should be enough isolation rooms available for each department. Hospital administrators should offer extension cord guidelines. Circuit breakers for earth leakage should be utilized. Each electrical panel should have insulating mats available. Professionals must do

routine maintenance and inspections, and the hospital administration shall address and adhere to the waste collection policy with the assistance of all staff members.

1.9.1 Personal protective equipment

Personal protective equipment (PPE) is the key goal of separating the two groups. We have provided protective and preventative measures for the entire system after the primary approach to dealing with and avoiding threats has been decided. Establishing control measures can aid in efficiently managing risks in the hospital. Protective measures are advised in light of the necessary tasks, exams, and follow-up period (Gul *et al.* 2017).

The medical staff's clothes should be comfortable for movement. Tight coveralls can increase the likelihood of muscle strain, make it harder to move freely, and cause skin and cloth to rub against one another. So, it is recommended to test the clothing in the final set. Also, the right personnel shoes should be used, such as low soles and heels with lots of traction for muddy areas that give the user a solid base while carrying objects. For tasks requiring physical handling, shoes should provide enough foot support, all-day comfort, and a solid base (Waters 2010).

The following safety precautions should be considered for all employees: An anti-HBs test is necessary for the initial stage of recruiting in relation to the activities of staff training and vaccinations (against hepatitis B, tetanus, diphtheria, pertussis, influenza, meningococcal disease, and chickenpox). The same test is required in cases of injuries from PPE usage and sound insulation activities. An anti-HBS test is necessary to ensure that auxiliary instruments are used properly in cases of accidents, stabbing injuries, and contact with blood and bodily fluids (wheelchairs, stretchers) (Gul *et al.* 2017).

The preventive measures are as follows, in brief: Employees shall be given an explanation of the data sheets pertaining to the health risks of chemicals on the material safety record. Cleaning agents should be purchased with the employees' potential

allergic reactions in mind. Elevators must adhere to all applicable regulations, which should be reviewed on a regular basis (Gul *et al.* 2017).

Hospital stretchers need to be inspected on occasion. The right number of workers should be hired based on the workload and requirements of the department. The number of personnel and patient-confined spaces should be increased in consideration of the working environment. Stairs should have safety walk steps, Hospital staff members must have access to a suitable rest place and breaks. To keep patients and guests healthier, a hospital cleaning checklist should be used (Gul *et al.* 2017).

2. MATERIAL METHODS

2.1 Research design

This study employed a descriptive cross-sectional research approach. This is due to the research being a fact-finding survey on the prevalence and risk factors for WRMSDs, and this kind of research design is highly recommended.

The research was conducted in the State of Iraq, in the province of Babil, in a government hospital selected and named Hilla General Teaching Hospital in the center of Babylon province, in the city of Hilla. The research began in October of 2022.

All departments of Hilla General Teaching Hospital were included: emergency, pulmonary resuscitation, surgeries, fractures, consultations, urinary system, and nervous system.

2.2 Sample Size

The research scientist consists of nurses in Hilla General Teaching Hospital, who number about 400 nurses of various academic degrees who work in all hospital departments and during official working hours, morning and evening.

Since the study population is specific, we used Yamane Law 1967 to calculate the research samples collected during the questionnaire (Yamane 1967).

The formula for the Yamane Act of 1967 is

$N = N \setminus 1 + n\ (e^2)$ where N is the population size and e is the accuracy level. A simplified formula was used to calculate the sample size of the population with a 95% confidence level and a p of 5%.

When the research data was put into the formula, it was concluded that the number of samples that could represent a universe of 400 people must be at least 201, according to the results of the calculation (Yamane 1967). The total number of our research samples was 207.

2.3 Population of the study

All nurses in Hilla Teaching Hospital in the city of Babylon and in all specialties (bachelor of nursing and above, diploma in nursing, preparatory nursing, nursing course) and in all departments of the hospital (operations, pulmonary resuscitation, emergency, consultant, surgical, fractions, boolean, and nervous sentence) as it includes both genders (male and female) and all age groups.

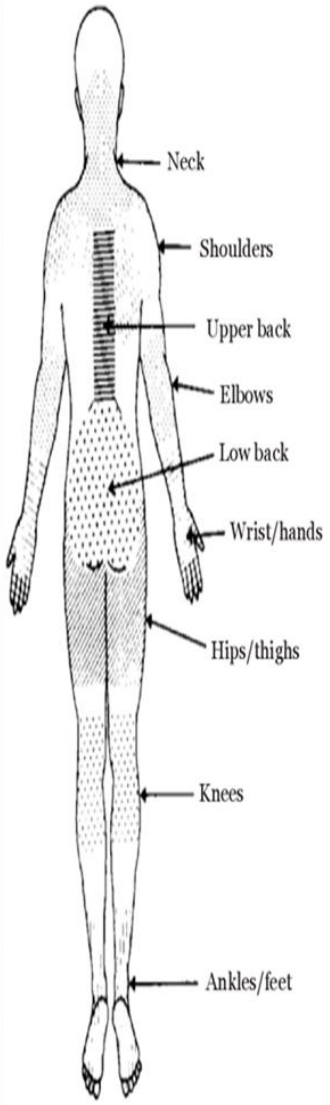
2.4 Data collection tools

The data collection tools for the research were the following questionnaires:

- Socio-demographic: A self-administered questionnaire was distributed randomly to individual nurses and then collected immediately after completion. The following information was gathered: Personal data: age, sex, body mass index (BMI), education level, physical exercise, years of experience, unit/ward, and working hours.
- Nordic Musculoskeletal Questionnaire (NMQ): It can be an inexpensive tool to identify and assess musculoskeletal risks in workers. This questionnaire covered nine areas of the body. The form consists of 27 questions with two choices: yes or no.

This questionnaire reports symptoms in nine body parts (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, ankles/feet) during the past 12 months/7 days. To answer this questionnaire, participants were asked to answer 'yes' or 'no' to the following question: 'Have you at any time during the past 12 months

experienced a problem (pain, pain, discomfort) in? followed by a list and a body diagram of the nine anatomical regions. If the respondent ticks "yes", they will be asked to answer the questions "At any time in at least 12 months you were prevented from doing your normal work (at home, away from home)" and "Did you face any problem at any time during the days past seven?".



Trouble with the locomotive organs		
Have you at any time during the last 12 months had trouble (ache, pain, discomport) in:	To be answered only by those who have had trouble	
	Have you at any time during the last 12 months been prevented from doing your normal work (at home or away from home) because of the trouble?	Have you any trouble at any time during the last 7 days?
Neck 1. No 2. Yes	1. No 2. Yes	1. No 2. Yes
Shoulders 1. No 2. Yes, in the right shoulder 3. Yes, in the left shoulder 4. Yes, in both shoulders	1. No 2. Yes	1. No 2. Yes
Elbows 1. No 2. Yes, in the right elbow 3. Yes, in the left elbow 4. Yes, in both elbows	1. No 2. Yes	1. No 2. Yes
Wrist/hands 1. No 2. Yes, in the right wrist/hands 3. Yes, in the left wrist/hands 4. Yes, in both wrist/hands	1. No 2. Yes	1. No 2. Yes
Upper back 1. No 2. Yes	1. No 2. Yes	1. No 2. Yes
Low back (small of the back) 1. No 2. Yes	1. No 2. Yes	1. No 2. Yes
One or both hips/thighs 1. No 2. Yes	1. No 2. Yes	1. No 2. Yes
One or both knees 1. No 2. Yes	1. No 2. Yes	1. No 2. Yes
One or both ankles/feet 1. No 2. Yes	1. No 2. Yes	1. No 2. Yes

Figure 2.1. The Nordic musculoskeletal questionnaire (NMQ) (Ramdan *et al.* 2019)

2.5 Administrative and ethical considerations

Before starting to collect study samples, it was necessary to obtain official approval from the head of the Research and Development Department for Medical Services in Babil Governorate. And from the administration of Hilla Teaching Hospital to complete my scientific research requirements.

The nurses were asked to obtain their consent to participate in the study and explain its purpose. Individual interviews were conducted with each nurse during their rest period without being disturbed during work. Individuals were made aware of their rights to refuse or leave the study. They also obtained guarantees that the information would be anonymous and used only for scientific studies. They were not asked to enter their names on the list of respondents either. The study did not include pregnant nurses, those with structural and congenital disabilities, or those who were injured in an accident rather than at work. The duration of the interview was only 15 to 20 minutes.

2.6 Data Analysis

The research data were analyzed using the SPSS for Windows 26.0 (SPSS-26 2019) software package. Descriptive statistical methods (frequency, percentage, min-max values, mean, and standard deviation) were used in the analysis of the relationship between quantitative data to find out the differences between the dependent variable and the independent variable, a one-way ANOVA.

A statistical procedure called analysis of variance (ANOVA) is used to examine variations between the means (or averages) of several groups. It is used in a variety of settings to determine whether there are any differences between the means of various groups. In this study, it was used for more than two factors: the independent t-test, which is a statistical test commonly referred to as the student's t-test, is used to compare the means of two groups. It is frequently employed in hypothesis testing to establish whether a procedure or treatment truly affects the population of interest or whether two

groups differ from one another. In order to compare continuous (or discontinuous), one-dimensional probability distributions for two factors, when testing homogeneity, the data appeared heterogeneous, so Kim was used to find out which factors had the most influence (Kim 2014).

The Kolmogorov-Smirnov test is employed to test the normality condition. This exercise demonstrates how to use SPSS to determine whether a variable may be considered to have a normal distribution. This is a crucial choice because, unless sample sizes are very large, the majority of parametric statistical tests that we explore are based on the supposition that variables are normally distributed. We will examine this visually as well as statistically using the Kolmogorov-Smirnov test (Ghasemi and Zahediasl 2012).

Table 2.1 Tests of normality

	Kolmogorov-Smirnov		
	Statistic	**Df**	**Sig.**
Suma	.194	206	0.52
Sumb	.253	206	0.61
Sumc	.244	206	0.503

According to this test, the data distribution is normal.

3. RESULTS

In this part of the study, the results of the application study conducted for the early detection of MSD in nurses teaching in health institutions in Iraq (and especially working in Hilla General Training Hospital) will be shared.

3.1 Description of the demographic data of the participants

According to the demographic characteristics of the nurses who participated in our study, the information on their normal activities due to their musculoskeletal disorders The results of the study revealed that the mean age of the participants was 32.43±9.5, 60.7% were male and (39.3%) female, 66% were married, 43.7% had a nursing diploma, 70.9% were non-smokers, 44.2% had a normal BMI, 69.4% practiced no physical exercise, 68.4% had years of experience between 1 and 10 years, and 25.7% worked in emergency service (see Table 3.1).

3.2 Prevalence of work-related musculoskeletal disorders

The results of the study revealed that most of the work injuries were in the lower back, where the injury rate reached 51.9%, followed by the neck at 37.4%, then the shoulders at 27.2%, and the lowest percentage was in the arm area and hips/thighs at 10.2%. As for the problems that occurred during the past six days, the highest percentage was in the lower back area by 32%, the neck by 18.4%, the shoulders by 13.1%, and the lowest percentage was in the arm area by 3.4%. Regarding the difficulty completing his daily tasks over the previous 12 months, it also had a 27.2% negative impact on the lower back, a 4.20% negative impact on the neck, and a 11.7% negative impact on the shoulders. The sum of the scale scores was 15.8 ± 3 (See Table 3.2).

Table 3.1 Description of the demographic data of the participants (n = 206)

Variable	**Mean ±SD**	**Min**	**Max**
Age	32.43±9.5	20	59
		n	**%**
Gender	Man	125	60.7
	Woman	81	39.3
Marital Status	Single	70	34
	Married	136	66
Educational Level	Nursing course	12	5.8
	Prep Nursing	38	18.4
	Nursing Diploma	90	43.7
	Bachelor's degree in Nursing	57	27.7
	Postgraduate	9	4.4
Smoking Status	Yes	146	70.9
	No	60	29.1
BMI	Underweight	16	7.8
	Normal	91	44.2
	Overweight	71	34.5
	Obesity	28	13.6
Physical Exercise	No	143	69.4
	Yes	63	30.6
Years of Experience	1-10 year	141	68.4
	11-20 year	35	17.0
	21-30 year	22	10.7
	31-40 year	8	3.9
Unit/ Ward	Operations	25	12.1
	Pulmonary resuscitation	41	19.9
	Emergency	53	25.7
	Consultant	15	7.3
	Surgical	25	12.1
	Fractions	18	8.7
	Boolean	12	5.8
	nervous sentence	17	8.3
Working hours per day	6 hours	111	53.9
	18 hours	95	46.1

Table 3.2 Prevalence of work-related musculoskeletal disorders (n = 206)

Variables	Have you at any time had trouble (ache, pain, discomfort, numbness)?		Have you had trouble at any time for at least six days?		Have you, at any time during at least 12 months, been prevented from doing your normal work at home or away from home because of trouble?	
	F	%	F	%	F	%
Neck	77	37.4	38	18.4	42	20.4
Shoulders	56	27.2	27	13.1	24	11.7
Elbows	21	10.2	7	3.4	9	4.4
Wrists/Hands	38	18.4	12	5.8	17	8.3
Upper back	46	22.3	33	16	26	12.6
Lower back	107	51.9	66	32	56	27.2
Knees	48	23.3	30	14.6	29	14.1
Hips/Thighs	21	10.2	7	3.4	8	3.9
Ankles/ Feet	43	20.9	23	11.2	20	9.7
Total score	15.8±3		15.4±3.4		15.4±3.45	

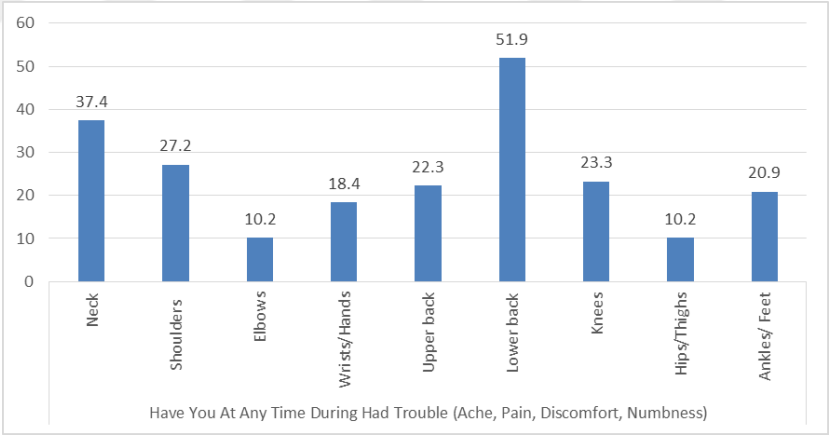


Figure 3.1 Prevalence of work-related musculoskeletal disorders

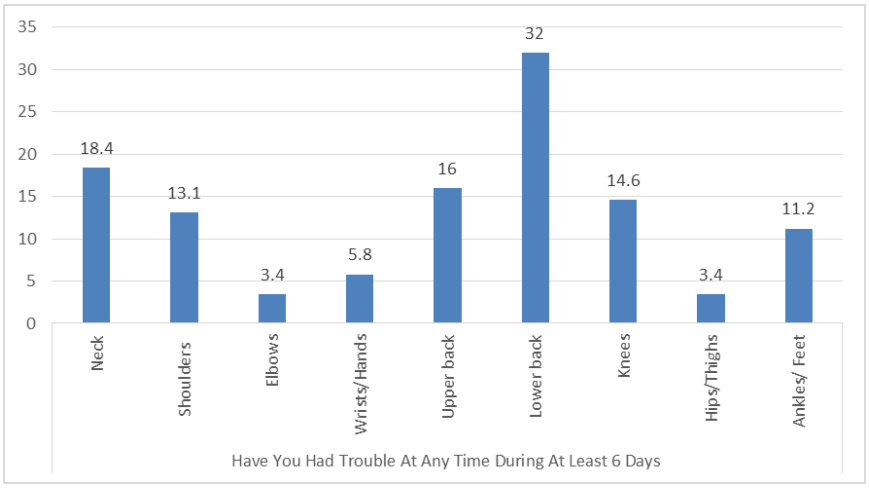


Figure 3.2 Prevalence of work-related musculoskeletal disorders during at least 6 days

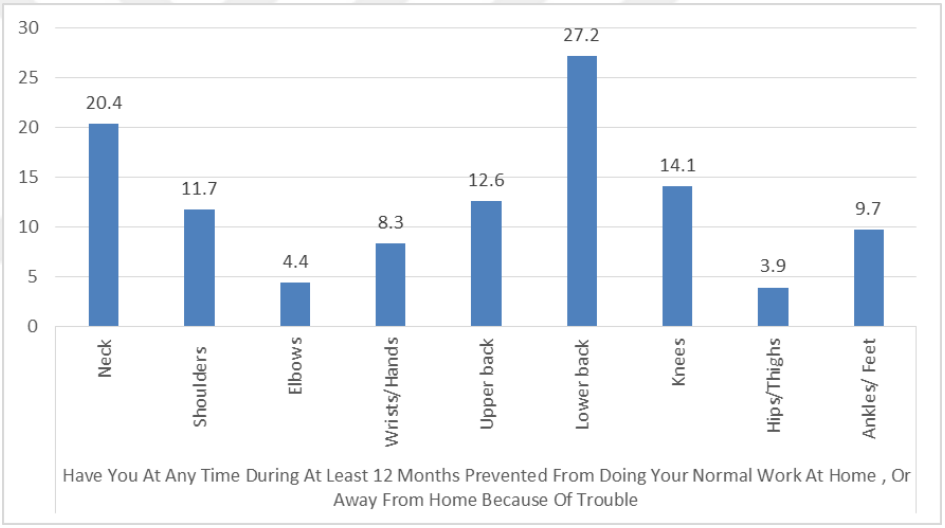


Figure 3.3 Prevalence of work-related musculoskeletal disorders during at least 12 months

3.3 Difference between work-related injuries and demographic data

The results of our study found that the average age group 20–30 was 14.14%, the age group 31–40 was 18%, the age group 41–50 was 18%, the age group 51–60 was 18.41%, and the f value was 45.341. There are statistically significant differences between WMSD and age, with a p value of less than 0.05. With regard to the level of

education, the average of graduates of the nursing course was 18.5%, the average of nursing preparatory graduates was 11%, the average of the nursing diploma was 16.84%, the average of the bachelor's degree was 18%, the average of the master's degree was 9%, and the f value was 476,581, and thus we found statistically significant differences between education level and WMSD, with a p-value of less than 0.05. With regard to BMI, the average of those with a low weight was 18.9%, the average of those with a normal weight was 14.59%, the average of those with a normal weight was 18%, and the average of obese people was 18.21%.

The f value was 150.445, and thus we found statistically significant differences between the mean BMI and WMSD with a p value of less than 0.05. As for the years of experience, the average of those with experience from 1–10 years was 14.8%, 11–20 years was 18%, 21–30 years was 18%, 31–40 years was 18.75%, and the f value was 22.528. Thus, we found statistically significant differences between years of experience and WMSD, with a p value of less than 0.05. With regard to the hospital departments, the average number of workers in the operations department was 9.48%, the pulmonary resuscitation department was 13.8%, and the emergency department was 16.75%. In the rest of the departments, the average was similar, which was 18%, and the f value was 168.607, and thus we found statistically significant differences between the hospital workplace and WMSD, with a P-value less than 0.05.

As for gender, the average for males in our study was 17.76%, the average for females was 12.87%, and the t-value was 14.677. Thus, we found statistically significant differences between sex and WMSD, with a p-value of less than 0.05. With regard to the marital status of the participants, the average of the married was 17.61%, the average of the single was 12.38%, and the t-value was 14.987.

Thus, we found statistically significant differences between marital status and WMSD, with a p value of less than 0.05. With regard to smoking, the average number of smokers among the participants was 14.9%, the average number of non-smokers was 18.1%, and the t-value was 11.593. Thus, we found statistically significant differences between smoking and WMSD, with a p-value of less than 0.05. With regard to aerobic

exercises, we found that the average of exercisers was 11.98%, the average of non-practitioners was 17.53%, and the t-value was 15.807.

Thus, we found statistically significant differences between exercise and WMSD, with a lower p value of 0.05. As for working hours, the average for 6-hour workers was 13.93%, and the average for 18-hour workers was 18.06%, and the t value was -13.917. Thus, we found statistically significant differences between working hours and WMSD, with a p value less than 0.05. (See Table 3.3).

Table 3.3. Difference between work-related injuries and demographic data (n=206)

Variables		N	Mean±SD	Test value	P value
Age	20-30	117	14.14±3.1	45.341[F]	0.000
	31-40	46	18±0.2		
	41-50	29	18±0.1		
	51-60	14	18.42±1		
Education	Nursing course	12	18.5±1.2	476.581[F]	0.000
	Prep nursing	38	11±1.4		
	Nursing diploma	90	16.84±0.9		
	Bachelor's degree in Nursing	57	18±0.001		
	Masters nursing	9	9±0.001		
BMI	Under weight	16	9.18±0.4	150.445[F]	0.000
	Normal	91	14.59±2.5		
	Over weight	71	18±0.001		
	Obesity	28	18.21±0.83		
Years of experiences	1-10 years	141	14.80±3.2	22.528[F]	0.000
	11-20 years	35	18±0		
	21-30 years	22	18±0		
	31-40 years	8	18.75±1.4		
Unit/ward	Operations	25	9.48±0.5	168.607[F]	0.000
	Pulmonary resuscitation	41	13.8±2.2		
	Emergency	53	16.75±0.9		
	Consultant	15	18±0		
	Surgical	25	18±0		
	Fractions	18	18±0		
	Boolean	12	18±0		
	nervous sentence	17	18.35±1		
Gender	Male	125	17.76±0.8	14.677[t]	0.000
	Female	81	12.87±2.9		
M.S	Single	70	12.38±2.8	-14.987[t]	0.000
	Married	136	17.61±0.9		
Smoking	No	60	18.1±0.5	11.593[t]	0.000
	Yes	146	14.9±3.2		
Physical activity	No	143	17.53±0.9	15.807[t]	0.000
	Yes	63	11.98±2.7		
Working hours	6 hours	111	13.93±3	-13.917[t]	0.000
	18 hours	95	18.06±0.4		

3.4 Test of Homogeneity of Variances

The results of our study showed that, when conducting a test of homogeneity between age and WMSD, depending on the mean, the levene statistic value was (121.726), df 1 (3), df 2 (202), p value < 0.05.

And it was found that in the test of homogeneity between the level of education and the WMSD, depending on the average, the levene statistic value was (63.36), df 1 (4), df 2 (201), p value < 0.05 and it was found that in the test of homogeneity between BMI and WMSD, depending on the mean, the levene statistic value was (99.011), df 1 (3), df 2 (202), p value < 0.05.

It was found that between the years of experience and the WMSD, depending on the mean, the levene statistic value was (62.84), df 1 (3), df 2 (202), p value < 0.05 and it was found in the test of homogeneity between hospital units and WMSD that, depending on the average, the value of the levene statistic was (71.2), df 1 (7), and df 2 (198), p value < 0.05.

It was found that in the test of homogeneity between gender and wmsd, depending on the mean, the levene statistic was (397.399), df 1 (204), df 2 (88.171), p value < 0.05.and it was found that in the test of homogeneity between marital status and wmsd, depending on the mean, the value of the levene statistic was (249.777), df 1 (204), df 2 (76.503), p value < 0.05. and it was found in the test of homogeneity between smoking and wmsd depending on the mean, the levene statistic (148.151), df 1 (204), df 2 (166.04), *p* value < 0.05.

It was found in the test of homogeneity between physical exercise and wmsd depending on the mean, the levene statistic (149.324), df 1 (204), df 2 (68.963), p value < 0.05 and it was found in the test of homogeneity between working hours and wmsd depending on the mean, the levene statistic (410.254), df 1 (204), df 2 (115.623), p value < 0.05, we found that the data is heterogeneous (see Table 3.4).

Table 3.4. Test of homogeneity of variances

Variables		Levene Statistic	df1	df2	p value
A*age	Based on Mean	121.726	3	202	0.000
A*education	Based on Mean	63.36	4	201	0.000
A*BMI	Based on Mean	99.011	3	202	0.000
A*years' experience	Based on Mean	62.84	3	202	0.000
A*unit	Based on Mean	71.2	7	198	0.000
A*gender	Based on Mean	397.399	204	88.171	0.000
A*M.S	Based on Mean	249.777	204	76.503	0.000
A*smoking	Based on Mean	148.151	204	166.04	0.000
A*physical	Based on Mean	149.324	204	68.963	0.000
A*Time of work	Based on Mean	410.254	204	115.623	0.000

Df: degree of freedom

3.5 Multiple Comparisons

The results of our study showed that there is an average difference between the average of the age group 20–30 and the age group 31–40 by (-3.85), the average of the age group 41–50 by (-3.85), the average of the age group 41–50 by (-3.85), and the average of the age group 51–60 by (-4.28). However, there is no average difference between the average age group 31–40 and the average age group 41–50 because the average of these groups is similar, and there is no average difference between the age group 31–40 and the age group 51–60, and there is no average difference between the age group 41–50 and the age group 51–60 because it has a p value of 0.5. Our study found that there is an average difference between the graduates of the nursing course and the graduates of preparatory nursing of 7.5, the nursing diploma of 1.65, and the Master of Nursing of 9.5, but there is no difference between the graduates of the nursing course and the Bachelor of Nursing because the difference between the averages is very small, by only 0.5. And the average difference between graduates of preparatory nursing and a diploma in nursing was -5.84, a bachelor of nursing by -7.0, and a master of nursing by 2. The average difference between nursing diploma graduates and Bachelor of Nursing graduates was (-1.15) and Master of Nursing by (7.84). It was found that there is no

average difference between the Bachelor of Nursing and the Master of Nursing because there is no value for p. The average difference between those with low weight and those with normal weight was -5.4, the above-normal was -8.8, and the obese was -9. And the average difference between those with normal weight and those with overnormal weight was -3.4, and that of those with obesity was -3.62. As for those who are overweight and those who are obese, there is no average difference between them because of the value of p.

The average difference between years of experience from 1–10 and (11–20) was (-3.19), 21–30 was (-3.19), and 31–40 was (-3.94). As for years of experience 11–20 and the rest of the years, there is no average difference between them, and so is 21–30, and the rest of the years there is no difference because of the value of p. As for the workplace, the average difference between the operations departments was pulmonary resuscitation (-4.32), emergency (-7.27), counseling (-8.52), surgery (-8.52), fractures (-8.52), urinary (-8.52), and nervous system (-8.87). And the average difference between pulmonary resuscitation and emergency was (-2.94), counseling (-4.19), surgery (-4.19), fractures (-4.19), urinary (-4.19), and nervous system (-4.19). And the average difference between emergency and counseling was (-1.24), surgical (-1.24), fracture (-1.24), urinary (-1.24), and nervous system (1.59).There is no average difference between the counseling and the rest of the other departments, as well as the surgical and the rest of the departments, fractures, and the rest of the urological and neurological departments, because the average is similar between them by 18% (see Table 3.5).

Table 3.5. Multiple Comparisons

Variables	(I) age	(J) age	Mean Difference (I-J)	Std. Error	p value	95% Confidence Interval	
						Lower Bound	Upper Bound
Age	20-30	31-40	-3.85470*	0.28989	0	-4.6103	-3.0991
		41-50	-3.85470*	0.28989	0	-4.6103	-3.0991
		51-60	-4.28327*	0.42402	0	-5.4173	-3.1492
	31-40	41-50	0	0	.	0	0
		51-60	-0.42857	0.30945	0.53	-1.3368	0.4797

Table 3.5 (continued) Multiple Comparisons

Education	Course of nursing	Secondary nursing	7.50000*	0.43256	0	6.216	8.784
		Diploma nursing	1.65556*	0.3735	0.005	0.4781	2.833
		Bachlirous nursing	0.5	0.35887	0.644	-0.6606	1.6606
		Master of nursing	9.50000*	0.35887	0	8.3394	10.6606
	Secondary nursing	Diploma nursing	-5.84444*	0.26275	0	-6.5874	-5.1015
		Bachlirous nursing	-7.00000*	0.2415	0	-7.6923	-6.3077
		Master of nursing	2.00000*	0.2415	0	1.3077	2.6923
	Nursing Diploma	Bachlirous nursing	-1.15556*	0.10351	0	-1.4438	-0.8673
		Master of nursing	7.84444*	0.10351	0	7.5562	8.1327
	Bachelorate	Master of nursing	9	0	.	9	9
BMI	Under weight	Normal	-5.40591*	0.28412	0	-6.1477	-4.6641
		Over weight	-8.81250*	0.10078	0	-9.103	-8.522
		obesity	-9.02679*	0.18684	0	-9.527	-8.5266
	Normal	Over weight	-3.40659*	0.26565	0	-4.102	-2.7112
		obesity	-3.62088*	0.30874	0	-4.4256	-2.8161
	Over weight	obesity	-0.21429	0.15734	0.533	-0.6448	0.2163
Years of Experience	1-10	11-20	-3.19858*	0.26976	0	-3.9	-2.4972
		21-30	-3.19858*	0.26976	0	-3.9	-2.4972
		31-40	-3.94858*	0.59123	0	-5.7246	-2.1725
	11-20	21-30	0	0	.	0	0
		31-40	-0.75	0.5261	0.524	-2.4915	0.9915
	21-30	31-40	-0.75	0.5261	0.524	-2.4915	0.9915
Unit	Operations	Pulmonary Resuscitation	-4.32488*	0.36916	0	-5.4963	-3.1534
		Emergency	-7.27472*	0.16658	0	-7.7942	-6.7553
		Consultant	-8.52000*	0.10198	0	-8.8578	-8.1822
		Surgical	-8.52000*	0.10198	0	-8.8578	-8.1822
		Fractions	-8.52000*	0.10198	0	-8.8578	-8.1822
		Boolean	-8.52000*	0.10198	0	-8.8578	-8.1822
		Nervous Sentence	-8.87294*	0.27594	0	-9.798	-7.9479
	Pulmonary Resuscitation	Emergency	-2.94984*	0.37845	0	-4.1457	-1.754
		Consultant	-4.19512*	0.35479	0	-5.3292	-3.061

Table 3.5 (continued) Multiple Comparisons

		Surgical	-4.19512*	0.35479	0	-5.3292	-3.061
		Fractions	-4.19512*	0.35479	0	-5.3292	-3.061
		Boolean	-4.19512*	0.35479	0	-5.3292	-3.061
		Nervous Sentence	-4.54806*	0.43775	0	-5.9271	-3.1691
	Emergency	Consultant	-1.24528*	0.13171	0	-1.6612	-0.8294
		Surgical	-1.24528*	0.13171	0	-1.6612	-0.8294
		Fractions	-1.24528*	0.13171	0	-1.6612	-0.8294
		Boolean	-1.24528*	0.13171	0	-1.6612	-0.8294
		Nervous Sentence	-1.59822*	0.28826	0	-2.5495	-0.647
	Consultant	Surgical	0	0	.	0	0
		Fractions	0	0	.	0	0
		Boolean	0	0	.	0	0
		Nervous Sentence	-0.35294	0.25641	0.855	-1.2407	0.5348
	Surgical	Fractions	0	0	.	0	0
		Boolean	0	0	.	0	0
		Nervous Sentence	-0.35294	0.25641	0.855	-1.2407	0.5348
	Fractions	Boolean	0	0	.	0	0
		Nervous Sentence	-0.35294	0.25641	0.855	-1.2407	0.5348
	Boolean	Nervous Sentence	-0.35294	0.25641	0.855	-1.2407	0.5348

3.6 Predictor variable responsible for the severity of WRMDs

The results of our study revealed that only physical exercises predict muscular risks during work (OR = 4.366, CL = 1.569–12.15). (See Table 3.6)

Table 3.6. Predictor variable responsible for the severity of WRMDs (n = 206)

Variables		B	SE	Wald	P value	Adjusted OR	95% Cl	
							Lower	Upper
Age	20-29	1.67	1.495	1.248	0.264	5.31	0.284	99.408
	30-39	1.379	1.43	0.93	0.335	3.97	0.241	65.473
	40-49	-0.272	1.281	0.045	0.832	0.762	0.062	9.376
	50+	0	.	.	.	.	.	.
Gender	Man	0.902	0.525	2.944	0.086	2.464	0.88	6.9
	Woman	0	.	.	.	.	.	.
Marital Status	Single	-0.769	0.424	3.295	0.069	0.463	0.202	1.063
	Married	0	.	.	.	.	.	.
Educational Level	Nursing Course	1.03	1.101	0.874	0.35	2.8	0.323	24.243
	Prep Nursing	-0.079	0.627	0.016	0.9	0.924	0.27	3.158
	Nursing Diploma	-0.187	0.503	0.139	0.71	0.829	0.31	2.221
	Bachelor's Degree İn Nursing & Above	0b	.	.	.	.	.	.
Smoking	No	-0.983	0.74	1.763	0.184	0.374	0.088	1.597
	Yes	0	.	.	.	.	.	.
BMI	Under Weight	0.474	0.779	0.371	0.542	1.607	0.349	7.391
	Normal	0.055	0.577	0.009	0.924	1.057	0.341	3.275
	Over Weight	0.474	0.649	0.535	0.465	1.607	0.451	5.732
	Obesity	0b	.	.	.	.	.	.
Physical Exercise	No	1.474	0.522	7.965	0.005	4.366	1.569	12.15
	Yes	0	.	.	.	.	.	.
Experience	1-10 Year	-0.308	1.758	0.031	0.861	0.735	0.023	23.058
	11-20year	0.534	1.631	0.107	0.743	1.706	0.07	41.716
	21-30year	1.915	1.738	1.214	0.27	6.788	0.225	204.709
	31-40year	0	.	.	.	.	.	.
Unit/Ward	Operations	2.03	1.309	2.403	0.121	7.611	0.585	99.055
	Pulmonary Resuscitation	-0.254	0.845	0.09	0.764	0.776	0.148	4.067
	Emergency	-0.159	0.825	0.037	0.847	0.853	0.169	4.301
	Consultant	1.027	1.265	0.659	0.417	2.792	0.234	33.323
	Surgical	1.466	1.255	1.365	0.243	4.332	0.37	50.664
	Fractions	-0.419	0.991	0.179	0.673	0.658	0.094	4.589
	Boolean	0.858	1.322	0.421	0.516	2.359	0.177	31.507
	Nervous Sentence	0	.	.	.	.	.	.

β= logistic regression; SE= Standard Error; OR= Odds Ratio; CI= Confidence Interval

4. DISCUSSION

In this part of the study, our research on the application study for the early detection of MSDs that may occur in the health sector was tried to be compared with other studies in the literature.

Musculoskeletal health is crucial for the individual because it allows for mobility, hand skills, and the capacity to participate in work activities and all parts of life. To be independent on economic, social, and functional levels throughout one's life, one must maintain good muscle health (Briggs *et al.* 2018). Nevertheless, musculoskeletal issues are a serious concern frequently seen in nurses working in the medical field (Mohammed *et al.* 2019). According to this study, nurses who work in hospitals are more likely to experience musculoskeletal problems. However, WMSDs among Iraqi nurses have not been thoroughly studied.

Regarding the demographic characteristics of the study samples in terms of age, the rate of nurses participating (20–29 years old) at 32.43% is the highest in the study. Because it is a surgical hospital that attracts more men than women, the majority of the nurses were young and recently employed men with an average age of 60.7. The percentage of those who are married is higher at a rate of 66%, with a nursing diploma at a rate of 43.7, smokers at a rate of 70.9, people of normal weight at a rate of 44.2, non-exercisers at a rate of 69.4, and having experience from 1 to 10 years at a rate of 4.68. Most of them were working in the emergency department at an average of 25.7, and most of them spent 6 hours at work at an average of 53.9. According to the study conducted by Abdullah, titled Prevalence Factors and Risks of Work-Related Musculoskeletal Disorders for Nurses in Erbil Teaching Hospitals, in the year 2018 in Iraq, the average age of the participants among the nurses was 30-39 at a rate of 42%, gender is female at 50.4%, 81.3% are married, non-smoking is 88.9%, diploma nursing is 57.6%, 1-10 experiences is 48.9%, non-physical exercises are 67.2%, work in surgical units is 30.2%, and BMI (over weight) is 45.4% (Abdulla 2018).

The prevalence of work-related musculoskeletal disorders among nurses, according to the Nordic questionnaire, which consists of eight regions of the body, According to the study, the neck came in second with a rate of 37.4%, and the lower back was the most common area among workers with an average of 51.9%. The least pervasive site is the elbows and hips, with an average of 10.2%. Most of the participants were suffering from lower back pain due to the transfer and carrying of the patient due to the lack of modern transfer machines in the hospital. In the study conducted by Betty, entitled "Evaluation of Work-Related Musculoskeletal Disorders Among Nurses in Mombasa County, Kenya," in 2016, the most general area of the body had a rate of 76.9% (Tanui 2016), and this is similar to the results of my study. In the study conducted by Sheikhzadeh *et al.* in 2009, which was entitled Perceptions of nurses and technicians about ergonomic risk factors in the surgical environment in the applied work environment at New York University, the most general area of the body was the lower back, with a rate of 84% (Sheikhzadeh *et al.* 2009). This result is consistent with the results of our study. In the study by Knibbe and Friele in 1996, titled "The prevalence of back pain and the characteristics of physical workload for nurses in the working environment community in the Netherlands," the most affected areas were the lower back, with 87% (Knibbe and Friele 1996).

Abstaining from doing your usual work at any time during the past 12 months due to musculoskeletal disorders in body regions; the most common area was the lower back, with a rate of 27.2%; neck, 20.4%; knees, 14.1%.

The lower back was the most painful area over the course of 12 years in the study by Knibbe and Friele in 1996 on the prevalence of back pain and physical workload characteristics among community nurses in the Netherlands (Knibbe and Friele 1996), which is consistent with the findings of our study. In the study conducted by Sheikhzadeh *et al.* (2009), which was entitled Perceptions of nurses and technicians about ergonomic risk factors in the surgical environment in an applied work environment at New York University, the most general area of the body during the 12 months was the lower back, with a rate of 84% (Sheikhzadeh *et al.* 2009). These results are consistent with the results of my study. In the study conducted by Abdullah, titled

Prevalence Factors and Risks of Work-Related Musculoskeletal Disorders for Nurses in Erbil Teaching Hospitals, in the year 2018 in Iraq, the most general area during the 12 months was the lower back by 75% (Abdulla 2018), and this is consistent with the results of our study.

As for whether there was a problem due to musculoskeletal disorders during the past 6 days, the most areas of the body that faced pain in the past 6 days were the lower back area, with a rate of 32%, the neck at 18.4%, and the knee at 14.6%. According to a study conducted by Knibbe and Friele in 1996, which was entitled Prevalence of Back Pain and Characteristics of Physical Workload for Nurses in the Work Environment Community in the Netherlands, the most general area during the past 6 days was the lower back with 20.6% (Knibbe and Friele 1996).

This result is consistent with our study. In the study conducted by Sheikhzadeh *et al.* (2009), which was entitled "Perceptions of nurses and technicians about ergonomic risk factors in the surgical environment in an applied work environment at New York University," the most general areas of the body during the past 6 days were the ankle and foot areas by 59% (Sheikhzadeh *et al.* 2009). These results do not agree with the results of our study.

Knowing the demographic characteristics that have a relationship with musculoskeletal disorders, it was found that gender ($p = 0.00$), exercise ($p = 0.00$), smoking ($p = 0.00$), age ($p = 0.00$), BMI ($p = 0.00$), work hours ($p = 0.00$), work units ($p = 0.00$), and years of experience ($p = 0.00$) had a relationship with musculoskeletal disorders ($p \leq 0.05$). In a study conducted by Abdullah, titled "Prevalence Factors and Risks of Work-Related Musculoskeletal Disorders for Nurses in Erbil Teaching Hospitals," in the year 2018 in Iraq, I found that there is a relationship between training, gender, and musculoskeletal disorders. However, there is no relationship between musculoskeletal disorders and occupational stress, smoking, exercise, or body mass index (Abdulla 2018). According to a study conducted by Betty, entitled "Evaluation of Work-Related Musculoskeletal Disorders Among Nurses in Mombasa County, Kenya," in 2016, it was found that there

is a relationship between musculoskeletal disorders and gender, and there is no relationship between the mass index and the body, smoking, or exercise (Tanui 2016).

In the study conducted by Stankvitz in 2015, which was entitled "Prevalence factors and risk factors associated with musculoskeletal disorders and work injuries in Sri Lankan rubber manufacturers in the US state of Carolina," it was found that there is a relationship between musculoskeletal disorders and age, years of experience, and gender, but no relationship between musculoskeletal disorders and educational level (Stankvitz 2015).

Demonstrating the homogeneity test between the variables depending on the average, it was found that there is no homogeneity between them because the value of p is less than 0.05. In the study conducted by de Araújo in the year 2022, which was titled Team Workload and Performance of Healthcare Workers with Musculoskeletal Symptoms, I found that there is homogeneity in some of the data, and in some there is no homogeneity.

In demonstrating the variables responsible for musculoskeletal disorders in my study, it was found that only exercise predicts the risk of musculoskeletal conditions at work. The risk factor associated with the occurrence of musculoskeletal disorders was exercise, because exercise is very important in maintaining physical fitness and a healthy body. In a survey conducted by Abdullah, titled Prevalence Factors and Risks of Work-Related Musculoskeletal Disorders for Nurses in Erbil Teaching Hospitals, in the year 2018 in Iraq, it was found that only training predicts musculoskeletal disorders at work (Abdulla 2018). In a study conducted by Nilsen et al. in 2011 entitled "Physical exercise, body mass index, and the risk of chronic pain in the lower back and neck/shoulders: longitudinal data from the Nord-Trndelag Health Study," it was shown that a decrease in exercise and weight gain increase the risk of chronic lower back pain (Nilsen *et al*. 2011).

5. CONCLUSIONS AND RECOMMENDATION

WRMSDs are a prevalent occupational health problem among healthcare workers that can result in significant physical, emotional, and financial burdens. Studies indicate that healthcare workers are at a higher risk of developing WMSDs compared to workers in other industries due to their unique job demands, such as patient handling and positioning, long working hours, and repetitive tasks. The primary WMSDs among healthcare workers include back pain, neck pain, shoulder pain, and carpal tunnel syndrome.

In this section, the results of this study, which was conducted for the early diagnosis of Musculoskeletal System disorders that nurses teaching in Iraq (at Hilla General Training Hospital) may experience in order to reduce occupational accidents to an acceptable level, will be discussed. Additionally, recommendations based on the findings of the study will be presented in this section.

5.1 CONCLUSION

Ergonomic interventions such as lifting equipment, adjustable workstations, and job rotation have been proposed as effective strategies to prevent and reduce WRMSDs among healthcare workers. Furthermore, interventions focused on educating healthcare workers about proper lifting techniques, posture, and ergonomics have shown positive results in reducing WMSDs.

However, despite the available evidence on the effectiveness of these interventions, their implementation remains a challenge. Many healthcare facilities lack the necessary resources, training, and support to effectively implement these interventions. Additionally, healthcare workers may be resistant to change due to long-standing work practices or a lack of awareness about the importance of ergonomic interventions.

Most of the participants in this study were from the age group (20–29) with a rate of 32.43%, and this indicates that most of the nurses are new profession owners and are not fully aware of the occupational risks and occupational diseases, so it was found that more than 51.9%) of the nurses have lower back pain, while those who participated in the study about WRMSD cases in any part of the body during 12 months had lower back pain (27.2%), followed by neck pain (20.4%), due to their insufficient knowledge of how to deal with patients.

This shows that nursing as a profession is a risk factor for WRMSD, although there could be other factors. In this study, there was a significant ($p \leq 0.05$) association between gender, smoking, exercise, and WRMSD. He also found that the most predictable risk for WRMSD is exercise, so it is extremely important for healthcare professionals to protect their body mechanics and know the risk factors for musculoskeletal pain in order to diagnose these problems early and prevent them from becoming chronic.

5.2 Recommendations

This study shows that work-related musculoskeletal disorders are an important occupational risk for nurses. It was concluded that there is a significant relationship between nurses' gender, smoking, exercise and WRMSD, and that the most ergonomic exercises should be done to prevent this risk. Therefore, nurses need to receive ergonomic training to protect their body health and to know the risk factors in order to prevent musculoskeletal pain from becoming chronic.

Suggestions developed on the subject can be listed as follows:

- Nurses should have training in proper patient handling and use of lifting equipment, rotate duties frequently, and reduce the number of patients being treated at one time.
- Nurses should pause, move away from uncomfortable situations, avoid household chores, and avoid lifting equipment.

- By conducting awareness programs for nurses about the risks of occupational diseases and how to prevent them, the competence and work productivity of hospital nurses and their quality of life will increase as the prevalence of WMSD decreases.
- The government and hospital director's role in carrying out these operations will be essential to the success of these prevention measures.
- Future research should focus on developing and implementing effective strategies to prevent and reduce WMSDs among healthcare workers.
- Studies that evaluate the cost-effectiveness of interventions, identify barriers to their implementation, and explore the perspectives of healthcare workers are needed.
- Furthermore, a better understanding of the underlying mechanisms that lead to the development of WMSDs among healthcare workers is essential to guide the development of effective interventions.

MSDs are a significant concern for nurses due to the physically demanding nature of their job. To help prevent WMSDs and promote the well-being of nurses, here are some precautions and best practices:

- Ergonomic Workstations: Ensure that workstations are ergonomically designed to minimize awkward postures, excessive reaching, and prolonged standing or sitting. Adjustable chairs, desks, and monitor heights are essential.
- Safe Patient Handling: Use proper body mechanics and safe patient handling techniques to reduce the risk of injury when lifting, transferring, or repositioning patients. Whenever possible, use mechanical lifts and transfer aids.
- Regular Breaks: Encourage nurses to take regular short breaks to rest and stretch. Prolonged periods of continuous work can increase the risk of WMSDs.
- Stretching and Exercise: Incorporate stretching exercises into daily routines to improve flexibility and muscle strength. Consider offering workplace wellness programs to promote physical fitness.

- Proper Lifting Techniques: Train nurses in proper lifting techniques, including bending at the knees, keeping the load close to the body, and avoiding twisting when lifting or transferring patients.
- Adequate Staffing: Ensure that there are enough staff members to handle the patient load. Overexertion and hurried work due to understaffing can increase the risk of injuries.
- Equipment Maintenance: Regularly inspect and maintain equipment used for patient care to ensure it functions properly and is safe to use.
- Personal Protective Equipment (PPE): Ensure that nurses have access to and use appropriate PPE to protect themselves from exposure to infectious agents, chemicals, and other hazards.
- Education and Training: Provide ongoing education and training on ergonomic principles, safe patient handling, and injury prevention techniques.
- Reporting and Incident Investigation: Encourage nurses to report any discomfort, pain, or signs of potential WMSDs promptly. Investigate incidents to identify root causes and implement corrective actions.
- Supportive Work Environment: Foster a workplace culture that values the health and safety of nurses. Encourage open communication and provide support for injured or at-risk staff.
- Rotation of Tasks: Rotate nursing staff through different tasks to reduce prolonged exposure to a single set of physical demands.
- Use Assistive Devices: Employ assistive devices and tools, such as lift equipment, slide boards, and mechanical aids, to reduce the physical strain on nurses when transferring or repositioning patients.
- Personal Health and Wellness: Promote a healthy lifestyle among nurses, including good nutrition, regular exercise, and stress management, as these factors can contribute to overall well-being and injury prevention.
- Infection Control: Implement stringent infection control practices to reduce the risk of infectious diseases, which can lead to additional physical stress and health complications for nurses.

Preventing WMSDs in nurses is a multifaceted effort that requires a combination of proper training, equipment, staffing, and workplace culture. Regular assessments and adjustments should be made to address specific risks in different healthcare settings.

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APPENDICES

APPENDIX 1. Socio-demographic characteristics of the nurses

APPENDIX 2. The standardized nordic questionnaire for musculoskeletal symptoms

APPENDIX 3. Editing certificate

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