7 Work-Related Musculoskeletal Disorders

7.1 LEARNING GOALS

The learning goals of this chapter are to provide an understanding of the origin, nature, and impact of work-related musculoskeletal disorders (WMSDs) in the global community. The student will also learn of the risk factors, evaluation techniques on a general process to establish an ergonomic program focused on reducing the risks of WMSDs in industry.

7.2 KEY TOPICS

- Structures impacted by WMSD
- Types of work-related musculoskeletal disorders
- Stages of work-related musculoskeletal disorders and principles of prevention
- Task-related risk factors
- Personal risk factors
- Screening methods
- Impact on industry
- OSHA ergonomic guideline for WMSD management

7.3 INTRODUCTION AND BACKGROUND

The World Health Organization (WHO), recognizing the impact of "work-related" musculoskeletal diseases, has characterized WMSDs as multifactorial, indicating that a number of risk factors contribute to and exacerbate these maladies (Sauter et al., 1993). The presence of these risk factors produced increases in the occurrence of these injuries, thus making WMSDs an international health concern. These types of injuries of the soft tissues are referred to by many names, including WRMDs, repetitive strain injuries (RSI), repetitive motion injuries (RMI), and cumulative trauma disorders (CTDs). The economic impact of these injuries is felt globally, particularly as organizations begin to develop international partnerships for manufacturing and service roles. Effective guidelines to reduce these risks and associated impacts can benefit the entire global community.

Musculoskeletal disorders have been diagnosed for many years in the medical field. In the nineteenth century, Raynauld's phenomenon, also called dead finger

or jackhammer disease, was found to be caused by a lack of blood supply and related to repetitive motions. In 1893, Gray gave explanations of inflammations of the extensor tendons of the thumb in their sheaths after performing extreme exercises.

Long before the Workers' Compensation Act was passed in Great Britain (1906) and CTDs were recognized by the medical community as an insurable diagnosis, workers were victims of the trade they pursued. Since these injuries only manifest themselves after a long period of time, they often went unrecognized. When the demand for labor increased dramatically after the Civil War, the number of children under the age of 15 working in industrial settings skyrocketed to 2 million. Many of these children, who were mostly underweight and malnourished, developed spine curvatures and suffered from stunted growth due to years of industrial labor. Those who worked in coal mines or cotton mills experienced the detrimental effects of breathing in those work environments, like bronchitis and tuberculosis. Additionally, accident rates increased due to the fatigue, as work hours had no legal limit (National Archives, 2011).

Some of the most common CTDs that surfaced were "anthrax from herding and sheep exposure; heavy metal poisoning; a variety of conditions from mining including beat knee, beat elbow and beat hand; inflammation of a variety of joints from mining; and hand difficulties called telegraphist's, writer's and twister's cramp" (Mandel, 2011). In 1929, the state of Ohio official recognized tenosynovitis of the hand as a medical condition, and over the next 25 years, carpel tunnel syndrome (CTS) was fully described in medical books. A full list of upper limb disorders, like "washer woman's sprain," "gamekeeper's thumb," "drummer's palsy," "pipe fitter's thumb," "reedmaker's elbow," "pizza cutter's palsy," and "flute player's hand" were eventually grouped into one of the following medical conditions: tendonitis, epicondylitis, CTS, cubital tunnel syndrome, myalgia, deQuervain's tenosynovitis, or traumatic arthritis (Mandel, 2011).

In 1934, Hammer confirmed that tendons could not resist more than 1500–2000 exertions per hour (Armstrong, 2002). During the 1930s and all the way through the 1950s, reports of inflammation of tendons and tendon sheaths in typists were very common. In the 1940s, both engineers and physicians were more knowledgeable of the impact that the design and operation of work equipment and work schedules had on musculoskeletal disorders. During and after the 1960s, physiological and biomechanical strains of human tissue, particularly of the tendons and their sheaths, revealed that they were indeed associated to repetitive tasks. As a result, several recommendations have been developed for the design and arrangement of workstations, as well as the use of tools and equipment to ultimately alleviate or reduce WMSDs.

7.4 STRUCTURES IMPACTED BY WMSD

Epidemiological studies have shown that in the presence of known risk factors such as force, repetition, and awkward posture, the muscles, joints, tendons, blood vessels, and nerves are at risk for musculoskeletal disorders. Bones are not generally considered to be at risk of these disorders; however, repetitive tasks can be detrimental on the vertebrae of the spinal column.

7.4.1 Muscles

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7.4.1 Muscles

Excessively stretching a muscle can lead to a strain. A strain is an injury to a tendon or muscle resulting in swelling and pain. When a group of fibers get torn apart, a more serious injury occurs. Obstruction of blood or nerve supply to the muscle can lead to complete deterioration of the muscle, if the obstruction occurs over an extended period of time.

Collagen fibers in tendons neither stretch nor contract, but if excessively strained, they can be torn. Scar tissue can develop making tendons more prone to repeated injuries and chronic tension. Furthermore, the surfaces on a tendon can become rough, interfering with motion and creating friction along other tissues. When a muscle relaxes or contracts, a tendon produces a gliding movement in its sheath. Some of these movements can be large, for example, when a finger is moved from a fully extended position to a contraction state, the tendon moves 5 cm.

Inflammation of a tendon can occur when there is not enough synovial fluid in the tendon sheath for lubrication and easy gliding. This causes friction between the tendon and its sheath, producing symptoms such as feelings of warmth, tenderness, and pain. These feelings result from an influx of blood, and further compression of the tissue causes more pain. Consequently, any movement of the swollen tendon is hindered and repeated movements can cause more fiber tissues to inflame, creating the possibility of a permanent chronic condition. A bursa is a flat sac that contains synovial fluid and a synovial membrane that facilitate normal movement of bones, muscles, or tendons by reducing friction between them. An overused tendon, especially if roughened, can cause its adjacent bursa to inflame and limits any movement of the tendon, thereby reducing joint mobility.

7.4.2 Nerves

A sprain results from ligament fibers becoming strongly stretched, pulled from the bone, or torn apart. A sprain can stem from either a single injury or repetitive activities producing a cumulative impact. Ligaments that are commonly injured are found in the joint areas such as the knee, ankle, and wrist areas. They can take weeks, or sometimes even months, to completely heal due to their diminished blood supply. A ligament sprain can result in joint instability and can increase the risk of further injury.

Increased pressure within the body occurs when the position of a body part decreases the size of the opening through which nerves run. This is called nerve compression, and it is primarily caused by pressure from ligaments, tendons, muscles, and bones. Also, hard surfaces and sharp edges of workplaces, tools, and equipment can trigger nerve compression. Motor nerves can become impaired, affecting the controlled activity of muscles generated by signals transmitted to the innervated muscle motor nerves. An example is the force or torque required to operate tools, equipment, and other work objects. Impairment of sensory nerves can also occur, making it difficult for information to be transmitted from the sensors in the body to the central nervous system. Symptoms of sensory nerve impairment include sensations of tingling, numbness, or pain. These signals are extremely

important because they contain information about the force and pressure applied, positions assumed, and motion experienced; thus, if impaired, it is possible that the operator may not realize certain task activities are increasing the severity of the condition.

7.4.3 Arteries and Vessels

Vascular compression, often of an artery, occurs when there is a constriction or obstruction of blood flow supply, as well as nutrients and oxygen through tissues, such as muscles, tendons, and ligaments. Vascular compression can result in ischemia, which affects both the duration of muscular activities and the recovery time of a fatigued muscle after performing a task. Another condition, called vasospasm, occurs from vibrations in certain body parts, particularly in the hands and fingers. Vasospasms decrease the diameter of blood vessels and, therefore, impede blood flow to the body areas in need of this blood supply. These areas become blanched, and in the hand this condition is known as the white finger (Raynaud's) phenomenon. Symptoms of vasospasms include intermittent or continual numbness and tingling, with the skin becoming pale and cold, and eventually loss of sensation and control. Vasospasms in the fingers are often a result of vibrations from powered hand tools and equipment such as chain saws, power grinders, pneumatic hammers, and power polishers.

7.5 TYPES OF WORK-RELATED MUSCULOSKELETAL DISORDERS

The frequency of work-related musculoskeletal injuries has led to classification and definition of these conditions in the medical and occupational environments. The classification of the conditions allows the scientific community to understand how to treat the conditions, as well as provides information that engineers can utilize to design processes and equipment to mitigate the risk factors. WMSDs can impact all areas of the body and some of the primary WMSDs experienced in the American industry are discussed in the following section.

7.5.1 Back Injuries

The back is the most frequently injured part of the body (22% of 1.7 million injuries) (NSC, Accident Facts, 1990) with overexertion being the most common cause of these injuries. However, many back injuries develop over a long period of time by a repetitive loading of the discs caused by improper lifting methods or other exertions. In fact, 27% of all industrial back injuries are associated with some form of lifting or manual material handling. These injuries are generally repetitive and result after months or years of task performance. Often injuries that appear to be acute are actually the result of long-term impact. The discs of the back vary in size, are round, rubber-like pads filled with thick fluid, which serve as shock absorbers. All the forces that come down the spine compress these discs, as a result of continuous and repetitive squeezing. In some instance discs can rupture and bulge producing pressure on the spinal nerve resulting in back pain.

7.5.2 Carpal Tunnel Syndro

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7.5.3 Tendonitis

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FIGURE 7.1 Carpal tunnel syndrom

7.5.2 Carpal Tunnel Syndrome

Perhaps the most widely recognized WMSD of the hand and forearm region is CTS, a condition whereby the median nerve is compressed when passing through the bony carpal tunnel (wrist). The carpal tunnel is comprised of eight carpal bones at the wrist, arranged in two transverse rows of four bones each. The tendons of the forearm muscles pass through this canal to enter the hand and are held down on the anterior side by fascia, called flexor and extensor retinacula, which are tight bands of tissue that protect and restrain the tendons as they pass from the forearm into the hand. If these transverse bands of fascia were not present, the tendons would protrude when the hand is flexed or extended. The early stages of CTS result when there is a decrease in the effective cross section of the tunnel caused by the synovium swelling and the narrowing of the confined space of the carpal tunnel. Subsequently, the median nerve, which accompanies the tendons through the carpal tunnel, is compressed and the resulting condition is CTS.

Early symptoms of CTS include intermittent numbness or tingling and burning sensations in the fingers. More advanced problems involve pain, wasting of the muscles at the base of the thumb, dry or shiny palms, and clumsiness. Many symptoms first occur at night and may be confined to a specific part of the hand. If left untreated, the pain may radiate to the elbows and shoulders (Figure 7.1).

7.5.3 Tendonitis

Tendonitis, an inflammation of tendon sheaths around a joint, is generally characterized by local tenderness at the point of inflammation and severe pain upon movement of the affected joint. Tendonitis can result from trauma or excessive use of a joint and can afflict the wrist, elbow (where it is often referred to as "tennis elbow"), and shoulder joints. (Figure 7.2).

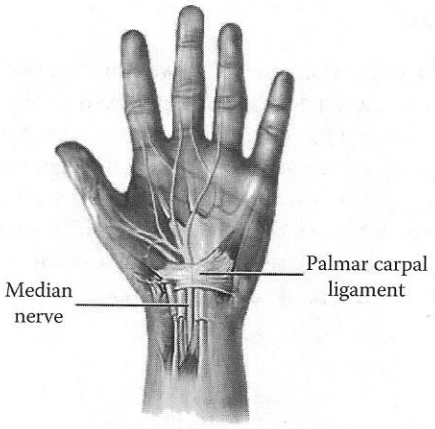


FIGURE 7.1 Carpal tunnel syndrome.

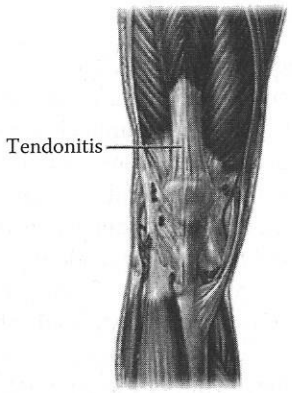


FIGURE 7.2 Tendonitis.

7.5.4 Tenosynovitis

Tenosynovitis is a repetition-induced tendon injury that involves the synovial sheath. The most widely recognized tenosynovitis is DeQuervain's disease. This disorder affects the tendons and sheaths on the side of the wrist and at the base of the thumb.

7.5.5 Intersection Syndrome and DeQuervain's Syndrome

Intersection syndrome and DeQuervain's syndrome occur in hand-intensive workplaces. These injuries are characterized by chronic inflammation of the tendons and muscles on the sides of the wrist and the base of the thumb. Symptoms of these conditions include pain, tingling, swelling, numbness, and discomfort when moving the thumb. (Figure 7.3).

7.5.6 Trigger Finger

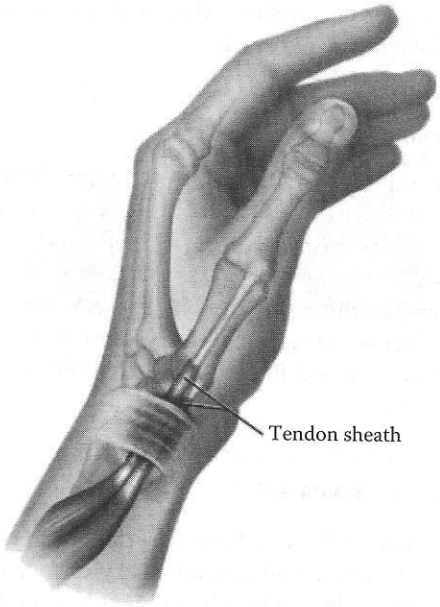
If the tendon sheath of a finger is aggravated, swelling may occur. Sufficient amounts of swelling may result in the tendon becoming locked in the sheath. At this point, if the person attempts to move the finger, the result is a snapping and jerking movement. This condition is called trigger finger. Trigger finger occurs to the individual or multiple fingers and results when the swelling produces a thickening on the tendon that catches as it runs in and out of the sheath. Usually, snapping and clicking in the finger arises with this disorder. These clicks manifest when one bends or straightens the fingers (or thumb). Occasionally, a digit will lock, either fully bent or straightened (See Figure 7.4).

7.5.7 Ischemia

Ischemia is a condition that occurs when blood supply to a tissue is lacking. Symptoms of this disorder include numbness, tingling, and fatigue depending on the degree of

FIGURE 7.3 DeQuervain's syndrome.

FIGURE 7.4 Trigger finger.



DeQuervain's disease

FIGURE 7.3 DeQuervain's syndrome.

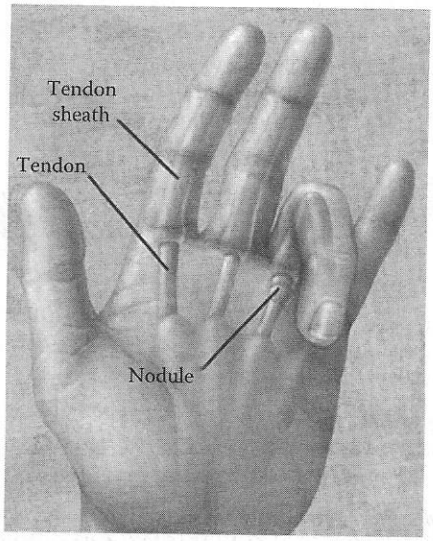


FIGURE 7.4 Trigger finger.

ischemia, or blockage of peripheral blood vessels. A common cause of ischemia is compressive force in the palm of the hand.

7.5.8 Vibration Syndrome

Vibration syndrome is often referred to as white finger, dead finger, or Raynaud's phenomenon. These conditions are sometimes referred to as hand arm vibration (HAV) syndrome. Excessive exposure to vibrating forces and cold temperatures may lead to the development of these disorders. It is characterized by recurrent episodes of finger blanching due to complete closure of the digital arteries. Thermoregulation of fingers during prolonged exposure to cold is recommended, as low temperatures reduce blood flow to the extremities and can exacerbate this condition (See Figure 7.5).

7.5.9 Thoracic Outlet Syndrome

Thoracic outlet syndrome (TOS) is a term describing the compression of nerves (brachial plexus) and/or vessels (subclavian artery and vein) to the upper limb. This compression occurs in the region (thoracic outlet) between the neck and the shoulder. The thoracic outlet is bounded by several structures: the anterior and middle scalene muscles, the first rib, the clavicle, and, at a lower point, by the tendon of the pectoralis minor muscle. The existence of this syndrome as a true clinical entity has been questioned, because some practitioners suggest that TOS has been used in error when the treating clinician is short on a diagnosis and unable to explain the patient's complaints. Symptoms of TOS include aching pain in the shoulder or arm, heaviness or easy fatigability of the arm, numbness and tingling of the outside of the arm or especially the fourth and fifth fingers, and finally

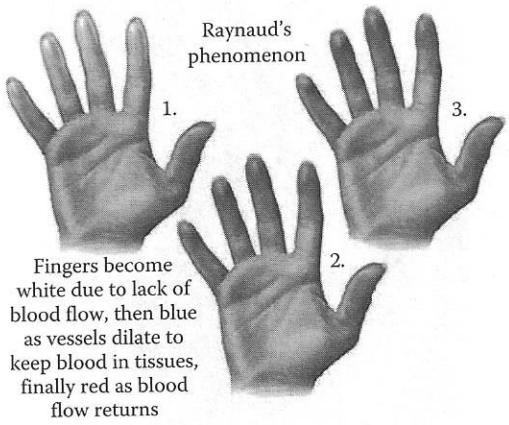


FIGURE 7.5 ***Raynaud's Phenomenon:*** This condition is characterized by the following stages: (1) Fingers becoming white due to lack of blood flow, then (2) blue due to oxygen consumption, and (3) finally red as blood flow returns.

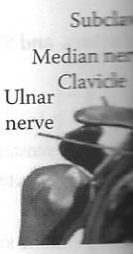


FIGURE 7.6 Thoracic outlet syndro

swelling of the hand or arm accom of the hand (See Figure 7.6).

7.5.10 Ganglion Cysts

Ganglion is a Greek word meanin like sacs, which are filled with a j and around tendons or on the palm cysts are not generally painful and treatment (Table 7.1) (See Figure

7.6 STAGES OF WMSD AN

Although *MSDs are cumulative i from person to person.* The signs appear either slowly or suddenly these disorders gradually:

- Stage 1
  - Workers experience m working hours.
  - Generally, symptoms go from work.
  - Work performance is n can continue for weeks
- Stage 2
  - Symptoms include tend that begin early in the w
  - Workers experiencing sleeping due to the pain
  - There is a reduction in
  - Stage 2 symptoms usual

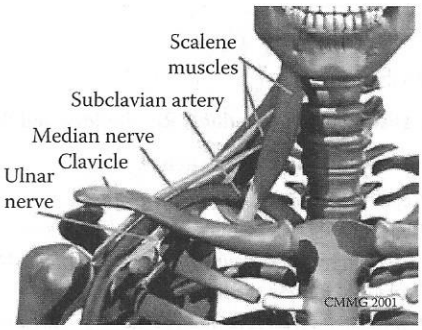


FIGURE 7.6 Thoracic outlet syndrome.

swelling of the hand or arm accompanied by finger stiffness and coolness or pallor of the hand (See Figure 7.6).

7.5.10 Ganglion Cysts

Ganglion is a Greek word meaning "a knot of tissue." Ganglion cysts are balloon-like sacs, which are filled with a jelly-like material. The maladies are often seen in and around tendons or on the palm of the hand and at the base of the finger. These cysts are not generally painful and with reduction in repetition often leave without treatment (Table 7.1) (See Figure 7.7).

7.6 STAGES OF WMSD AND PRINCIPLES OF PREVENTION

Although *MSDs are cumulative in nature, the recognition of these disorders varies from person to person.* The signs and symptoms of musculoskeletal disorders can appear either slowly or suddenly. Three stages have been established to categorize these disorders gradually:

- Stage 1
  - Workers experience momentary aches and tiredness during normal working hours.
  - Generally, symptoms go away on their own overnight and over days off from work.
  - Work performance is not affected during this stage, but the symptoms can continue for weeks or even months.
- Stage 2
  - Symptoms include tenderness, swelling, weakness, numbness, and pain that begin early in the work shift and do not go away overnight.
  - Workers experiencing stage 2 symptoms may have a difficult time sleeping due to the pain and discomfort.
  - There is a reduction in work performance, specifically repetitive work.
  - Stage 2 symptoms usually last for months.

TABLE 7.1
Summary Table of WMSD

Identified Disorders, Occupational Risk Factors, and Symptoms

Disorders	Occupational Risk Factors	Symptoms
Tendonitis/ tenosynovitis	Repetitive wrist motions Repetitive shoulder motions Sustained hyperextension of arms Prolonged load on shoulders	Pain, weakness, swelling, burning sensation, or dull ache over affected area
Epicondylitis (elbow tendonitis)	Repeated or forceful rotation of the forearm and bending of the wrist at the same time	Same symptoms as tendonitis
Carpal tunnel syndrome	Repetitive wrist motions	Pain, numbness, tingling, burning sensations, wasting of muscles at base of thumb, dry palm
deQuervain's disease	Repetitive hand twisting and forceful gripping	Pain at the base of thumb
Thoracic outlet syndrome	Prolonged shoulder flexion Extending arms above shoulder height Carrying loads on the shoulder	Pain, numbness, swelling of the hands
Tension neck syndrome	Prolonged restricted posture	Pain

Source: Canadian Occupational Safety and Health, http://www.ccohs.ca/oshanswers/diseases/rmirsi.html (accessed April, 2011)

- Stage 3
  - Symptoms during this stage persist even when the person is at complete rest.
  - Frequently, sleep is disturbed and pain is felt even with non-repetitive motions.
  - Work performance is highly affected, even when performing light tasks in daily life.
  - Stage 3 symptoms persist for months or years.

The action to reduce risks should be taken immediately upon recognition of these symptoms. Stage 1 symptoms can be relieved through work changes, such as taking more rest breaks throughout the work shift and task rotation. When experiencing stage 2 or stage 3 symptoms, it is extremely important to completely abandon the task or tasks that are creating the pain or injuries. Additional care may be required including physiotherapy, drugs, and other medical treatments, including surgery. Early detection of a musculoskeletal disorder is essential, as it allows for more efficient treatment and complete recovery. Ergonomically, it is crucial to identify any potentially harmful activities as early as possible in order to mitigate or avoid risks either through work modifications or work redesign.

The identification of WMSDs can sometimes be difficult in the medical and occupational setting due to the cumulative progression of these conditions. A guideline

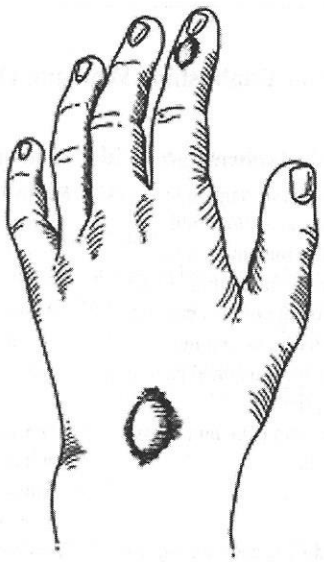


FIGURE 7.7 Ganglion Cyst on hand.

for the minimal clinical criteria for establishing worksite diagnoses has been proposed by Ranney et al. (1995). These criteria provide expected symptoms and examination procedures for baseline evidence of WMSDs (Tables 7.2 and 7.3).

7.7 TASK-RELATED RISK FACTORS

A comprehensive review of epidemiological studies was performed to assess the risk factors associated with WMSDs (*Musculoskeletal Disorders and Workplace Factors*, NIOSH, 1997). The review categorized WMSDs by the body part impacted including (1) neck and neck-shoulder, (2) shoulder, (3) elbow, (4) hand-wrist, and (5) back. The widely accepted task-related risk factors include repetition, force, posture, vibration, temperature extremes, and static posture (NIOSH, 1997). The degree of impact is synergistic when two or more factors exist. The risk factors for each region of the body are described in this review as follows:

1. Neck and neck/shoulder risk factors
   a. *Repetition*—cyclical work activities that involve either repetitive neck movements (i.e., the frequency of different head positions during a cycle), or repeated arm or shoulder motions that generate loads to the neck-shoulder area (i.e., trapezius muscle).
   b. *Force*—forceful exertions involving the upper body that generates loads to the trapezius and neck muscles.
   c. *Posture*—adverse or extreme head or neck postures or static postures of the head and/or neck.

TABLE 7.8
Sectors with Highest WMSD in Europe

Sectors with the Highest Relative Number of New MSD Cases (per 100,000 Workers)		Sectors with the Highest Number of Work-Related MSD Complaints (per 100,000 Workers)	
Mining and quarrying	960	Health and social work	4283
Manufacturing	81	Transport and communication	3160
Construction	50	Construction	3158
Total population	32	Total population	2645

organizations, it is imperative to acknowledge and address this problem on an international level. An epidemic of WMSDs affecting VDT operators swept Australia in the last decade. In fact, prevalence rates of almost 35% were recorded in some Australian organizations (Sauter et al., 1991). The high-tech, Japanese industry is also experiencing an adverse impact due to the occurrence of WMSDs. Japanese organizations have reported surges in the number of occupational-related musculoskeletal injuries (Sauter et al., 1991). This further illustrates the need to have comprehensive guidelines for mitigating the risks of work-related musculoskeletal injuries internationally.

WMSDs are clearly a global occupational issue and less than a decade ago were considered the most important work-related health problem in Europe (OSHA EU, 2003). In 2003, for every 100,000 workers, there were 32 new WMSD cases, resulting in WMSDs accounting for 50% of all new cases of occupational disorders in the EU (2003 data), and 50% of all work-related health problems in Europe (1999 data). Efforts have been made to mitigate the impact of these risk factors (OSHA EU, 2003) through the implementation of screening methods, education, and improved workplace design. Ergonomic measures to control common WMSDs include workplace redesign, utilization of ergonomically designed, training hand tools, and other methods to minimize the occurrence of the risk factors. Table 7.4 provides a few ergonomic measures to control common WMSDS (Kroemer et al., 1994).

7.11 PROCEDURE FOR WORKPLACE ANALYSIS AND DESIGN

Job analysis, risk factor assessment, and task design should be conducted to identify potential work-related risks and develop engineering controls, administrative controls, and personal protective resources to mitigate the likelihood of injuries. According to American National Standards Institute (ANSI, 1995), this can be accomplished with the following steps (Karwowski and Marras, 1997):

- Collect pertinent information for all jobs and associated work methods.
- Interview a representative sample of affected workers.
- Breakdown a job into tasks or elements.
- Description of the component actions of each task or element.

- Measurement and qualification or quantification of WMSDs (where possible).
- Identification of risk factors for each task or element.
- Identification of the problems contributing to the risk factors.
- Summary of the problem areas and needs for intervention for all jobs and associated new work methods.

These steps can be executed utilizing any combination of scientifically based assessment techniques including checklists, surveys, electronic measurement equipment, software tools, and analysis approaches.

7.12 ERGONOMIC PROGRAM FOR WMSD

In 1999, OSHA culminated years of scientific study into a proposed ergonomic standard to address the frequency and severity of WMSD in the U.S. occupational environment. The standard was implemented but almost immediately repealed with the transition of leadership in the U.S. presidency. Despite the repealing of the legislation, the guidance offered in the standard serves as a guideline for industries to develop programs to reduce and manage WMSD.

The primary elements of the former OSHA Ergonomics Legislation were developed using as guidelines comprehensive organizational involvement. This includes management leadership, demonstration of employee participation and knowledge of WMSD, hazard identification, job hazard analysis control, and finally employee training. The responsibilities that an organization will accept in the implementation of this process can be classified as

- Management leadership and employee participation
- Job hazard analysis and control
- Training
- WMSD management
- Program evaluation

Each of these areas is discussed and presented in more detail in the following text.

7.12.1 Management Leadership

Management leadership requires the leadership to take an active and participatory role in addressing and reducing the presence of WMSDs. Specific activities that demonstrate an active concern for employee health and safety include

- Assignment and communication of responsibilities
- Empowering employees to make changes
- Examination of existing policies and practices
- Communication with employees regarding the program
- Prompt response to employee reports of problems

7.12.2 Employee Participation

Employee participation is designed
the reduction of the risks and occur
pation should include

- Employee participation in the
of WMSDs
- Access to OSHA standards a

7.12.3 Job Hazard Analysis a

Job hazard analysis and reporting
workplace. Some of the activities
WMSD signs and get quick respon

- Provide information to curre
  - *Common WMSD hazard*
  - Signs and symptoms of
  - How to report WMSD s
- Hazard analysis activities wi
  - Evaluation of the proble
  - Implement controls to h
  - Use an incremental abo
  - When a WMSD hazard
materially reduce the W
  - If WMSD hazard is still
trols to reduce WMSDs
  - Keep implementing con

7.12.4 Training

An important part of a successful
employees is essential and should

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- When employee is assigned
- Periodically, at least every 3

Train the persons involved in setti

- When initially assigned to se
- Periodically, at least every 3

7.12.5 WMSD Management

In WMSD management, the em
workplace and presence of injuries

7.12.2 Employee Participation

Employee participation is designed to allow employees to be active participants in the reduction of the risks and occurrence of these injuries. Specific employee participation should include

- Employee participation in the procedure for reporting signs and symptoms of WMSDs
- Access to OSHA standards and information about the ergonomics program

7.12.3 Job Hazard Analysis and Reporting

Job hazard analysis and reporting is designed to identify and remove risks from the workplace. Some of the activities include setting up a way for employees to report WMSD signs and get quick responses as well as the following:

- Provide information to current and new employees:
  - *Common WMSD hazards.*
  - Signs and symptoms of WMSDs.
  - How to report WMSD signs and symptoms.
- Hazard analysis activities will include the following:
  - Evaluation of the problem job to identify "ergonomic risk factors."
  - Implement controls to help eliminate or reduce WMSD hazards.
  - Use an incremental abatement process.
  - When a WMSD hazard occurs, implement one or more controls to materially reduce the WMSD hazards.
  - If WMSD hazard is still occurring, implement additional feasible controls to reduce WMSDs further.
  - Keep implementing controls until the elimination of WMSD hazards.

7.12.4 Training

An important part of a successful ergonomic program is training. The training of employees is essential and should include training employees an follows:

- When the job is identified as a hazard
- When employee is assigned to the problem job
- Periodically, at least every 3 years

Train the persons involved in setting up and managing the ergonomics program

- When initially assigned to setting up and managing the ergonomics program
- Periodically, at least every 3 years

7.12.5 WMSD Management and Program Evaluation

In WMSD management, the employer continually assesses the condition of the workplace and presence of injuries with respect to WMSDs. This includes evaluation

of injuries that occur after the implementation of the program and incorporation of additional activities to mitigate risks when necessary. Program evaluation is designed to ensure ongoing effectiveness of the program methods in reducing the risks of injury. To evaluate the ergonomics program an employer must

- Consult with employees in problem jobs to assess their views on the effectiveness of the program
- Identify any significant deficiencies in the program
- Evaluate the elements of the program to ensure they are functioning properly
- Evaluate the program to ensure it is eliminating or materially reducing WMSD hazards

Although this legislation is no longer in effect, it serves as a useful guideline for the establishment of a workplace ergonomics program.

7.13 SUMMARY

Awkward postures, repetitive work, or handling heavy loads are among the risk factors that studies have shown to damage the bones, joints, muscles, tendons, ligaments, nerves, and blood vessels, leading to WMSDs. WMSDs are mostly cumulative, resulting from repeated exposure to loads at work over a period of time. Upper limbs (the hand, wrist, elbow, and shoulder), the neck, and lower back are particularly vulnerable to MSDs. The design of tools, equipment, processes, and work spaces can have a tremendous effect on the risks and occurrence of WMSD.

Despite the growing knowledge of CTDs, according to a survey taken in 1992, the number of CTDs had tripled since 1984. Although a minority of dissenters believes CTDs are a sociopolitical phenomenon with no real scientific grounds, most believe the injuries result from the fact that humans were not built to perform certain tasks requirements at excessive levels. When they do unnatural movements or sit in positions that are not conducive to the human anatomy, the tissue is distorted and swells and eventually begins to tear, causing pain and discomfort. The good news is most CTDs are preventable, if organizations take the time to engineer risk factors out, implement administrative controls and train employees in proper lifting and posturing techniques. Regular job rotation, break enforcement, redesign of the workspace, and personal protective equipment are all preventative measures employers can make to protect their. Companies who manage their CTD risks often find the cost of mitigation will be offset by reduction in medical claims and ultimately a reduction in worker's compensation insurance.

The list in the following text represents ergonomic screening and analysis tools that can be useful in assessing ergonomic risks, particularly for WMSD. These ergonomic tools were obtained from a variety of sources including OSHA; Department of Design and Analysis, Cornell University; Center for Ergonomics at the University of Michigan; Dr. Thomas Bernhard, University of South Florida; and the Human Factors and Ergonomics Society.

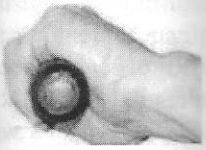
TABLE 7.9
Comparison of Five

Power grip
The hand grip that provides
fingers wrap around the

Contact pressure
Pressure from a hard surface,

Pinch grip
The hand grip that provides
gripped between the thumb

Single-handle tools
Tube-like tools measured by
a straight line through the



Double-handle tools
Plier-like tools measured by
between the thumb and finger

Source: NIOSH website,