California Association for Medical Laboratory Technology

Distance Learning Program

Ergonomics
Course # DL-906

by
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Approved for 2.0 CE
CAMLT is approved by the California Department of Public Health as a CA CLS Accrediting Agency (#21)

Level of Difficulty: Intermediate

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**DISTANCE LEARNING ANSWER SHEET**

Please circle the one best answer for each question.

**COURSE NAME:** **ERGONOMICS**

**COURSE #:** DL-906

**NAME** ____________________________________  **LIC. #** __________________  **DATE** ____________

**SIGNATURE (REQUIRED)** ______________________________________________________________

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**DISTANCE LEARNING EVALUATION FORM**

According to state regulations, this form must be completed and returned in order to receive CE hours. Your comments help us to provide you with better continuing education materials in the distance learning format. Please circle the number that agrees with your assessment with, with 5 meaning you strongly agree and 1 meaning you strongly disagree.

1. Overall, I was satisfied with the quality of this Distance Learning course.
   5 4 3 2 1

2. The objectives of this Distance Learning course were met.
   5 4 3 2 1

3. The difficulty of this Distance Learning course was consistent with the number of CE hours.
   5 4 3 2 1

4. I will use what I learned from this Distance Learning course.
   5 4 3 2 1

5. The time to complete this Distance Learning course was: ________ hours

6. Please comment on this Distance Learning course on the back of this sheet. What did you like or dislike?
ERGONOMICS: An Intermediate Self-Study Package for Safety
DL-906
2.0 CE
Level of Difficulty: Intermediate

Dan Scungio, MT(ASCP), SLS, CQA (ASQ)
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Objectives:

At the conclusion of this course, the participant will be able to:

1. discuss ergonomic illnesses and their cause
2. list an activity to prevent repetitive motion injuries
3. differentiate between administrative and work practice controls
4. describe proper computer workstation setup

Introduction

During World War II, with the operation of complex military equipment, technology, and human sciences were coordinated in the field by an interdisciplinary approach. This approach was so promising that in 1949 industry founded the first national ergonomics society in England. In 1961, the International Ergonomics Association was formed which represents over 40 countries. Over the last 50 years ergonomics has contributed to the solution of a number of social problems related to safety, health, comfort, and efficiency.

Many work and everyday situations are hazardous to our health. Musculoskeletal illnesses such as lower back pain, and psychological illnesses due to stress constitute the most important cause of work-related absence due to illness and occupational disability. These conditions can be partly due to poor design of equipment, technical systems, and tasks. The reporting of cumulative trauma disorders (CTD) and other work-related disorders because of ergonomic hazards have increased significantly. Much of the increase is due to changes in process and technology that exposes employees to increased repetitive motion and other ergonomic risk factors. The Occupational Safety and Health Administration (OSHA) expects that CTD will be 70% of all injuries reported at a cost of $20 billion per year.

On November 14, 1996, the California Occupational Safety and Health Standards Board passed the Repetitive Motion Injuries (RMI) Standard which applies to businesses with 10 or more employees that have a job, process, or operation in which repetitive motions occur. The RMI program must include worksite evaluation, interventions to control the exposures that have caused RMI, and employee training. Worksite evaluation involves the identification of worker exposure to known or suspected risk factors for RMI. The exposure identified should be eliminated by engineering controls where possible or minimized using work practice and administrative control strategies. Employee training must cover the ergonomics program, exposure associated with RMI, the symptoms and consequences of RMI, the need for early
reporting to the employer, and how RMIs are being minimized by the employer. A laboratory example would be in an immunology laboratory where manual pipetting is performed. Replacing the thumb-operating pipette with a trigger-operating device would be a work practice control. However, a piece of equipment which does the pipetting automatically would be an engineering control and rotating the work requirements among the staff plus training the staff in proper hand exercises would be an administrative control strategy.

In order to comply with the law and have an effective program, it is important to be objective, look beyond specific requirements, and address all hazards. Commitment by management is the key to motivating employees and providing the resources for a safe workplace. Worker safety and health is a fundamental concern of any organization and commitment to that end should be an organizational goal. Employee involvement and feedback are essential.

**Ergonomic Illness**

Posture and movement play a key role in ergonomics. Poor posture or movement causes a variety of musculoskeletal disorders and illnesses. A musculoskeletal disorder (MSD) or illness is one involving the muscles, tendons, ligaments, nerves, joints, bones, or supporting vasculature. These injuries include disorders of the back, neck, upper or lower extremities, or shoulders and involved strains, sprains, or tissue inflammation and dislocation. Environmental factors include demands on the body that exceed working strength and endurance such as heavy lifting, constant twisting, and repeated motions such as pipetting or data entry. Biological factors are the physical characteristics of the worker including size, endurance, and range of motion and strength. An injury results when the job demands exceed the physical characteristics of the worker.

Cumulative trauma disorders (CTD) are musculoskeletal and nervous system disorders that may be caused or aggravated by repetitive motions, forceful exertions, vibration, mechanical compression, sustained or awkward postures, or exposure to noise over extended periods. They can affect nearly all tissues, nerves, tendons, and muscles. These painful and sometimes crippling injuries develop gradually over weeks, months, or years and arise from repeated actions, such as twisting and bending of the extremities. According to the Bureau of Labor Statistics, CTD are major occupational health hazards in the workplace and account for the largest share of occupational illnesses today.

Tendonitis is a form of tendon inflammation that occurs when a muscle or tendon is repeatedly tensed from overuse of the wrist and shoulder. The tendon becomes thick, bumpy, and irregular in certain areas of the body whenever the shoulder and the injured area begin to calcify. Without rest and sufficient time for the tissues to heal, the tendon may be permanently damaged. Tendonitis can easily occur in phlebotomists.

Trigger finger is attributed to the creation of a groove in the flexing tendon of the finger. If the tendon becomes locked in the sheath, attempts to move that finger will cause snapping and jerking movements. This disorder is often associated with using tools that have handles with hard or sharp edges such as in the gross room of anatomic pathology.
Carpal tunnel syndrome (CTS) affects the hands and wrists and is the compression and entrapment of the median nerve where it passes through the wrist and into the hand in the carpal tunnel. When irritated, tendons housed inside the narrow carpal tunnel swell and press against the nearby median nerve. The pressure causes tingling, numbness, or severe pain in the wrist and hand. The pressure also results in a lack of strength in the hand and an inability to make a fist, hold objects, or perform other manual tasks. If the pressure continues, it can cause permanent loss of sensation and even partial paralysis. CTS occurs when repetitive manual tasks such as manual pipetting, data entry into a computer, or transcription are performed over time. Compounding the problem is that employees often do not associate their pain with their work because symptoms may only occur during off-duty hours.

Back disorders are frequently caused by faulty body mechanics such as poor posture; bending and reaching; and carrying, moving, or lifting loads that are too heavy or too big. Keeping the body in a neutral position with the work close to the body is helpful in maintaining proper posture. Exhausted muscles take a long time to recover and need to rest for 30 minutes to achieve a 90% recovery. Distributing the resting time throughout the day can reduce muscle fatigue. For example, it is better to have a five-minute rest break every hour rather than a 15-minute break during a four-hour period.

Temperature extremes may also increase the risk of ergonomic disorders. Cold temperatures can affect a worker’s coordination and manual dexterity, thus requiring more effort and additional manual force to perform the same task or to maintain productivity levels. Likewise, hot and humid conditions can result in increased ergonomic stress by causing excessive fatigue or reducing the employee’s work capacity.

**Work Analysis**

The first step in the worksite analysis is to determine what jobs and workstations are the source of the greatest problems. A systematic analysis of injury and illness records can accomplish this step. The existing medical, safety, and insurance records must be analyzed for evidence of CTD or back disorders. The OSHA 300 log (the quarterly reporting document for illnesses/injuries that result in lost time from work) should also be reviewed. Next, identification and analysis of trends or ergonomic problems relating to particular laboratory section, workstations, job titles, or operations are performed. Each workstation that is considered a problem or high risk should be analyzed via direct observation with assistance from qualified personnel such as an ergonomist (a scientist who studies how workstations can be adapted to the people who use them), a health-care provider, or an affected employee familiar with the risks. Use of a symptom survey checklist, ([Figure 1](#)) a complaint log or a suggestion box may also be useful.

An ergonomic committee in the laboratory of a large midwestern university medical center recently completed a review of its accident and OSHA 300 logs as well as its worker’s compensation claims for the past three years. That information – along with the employee symptom survey checklist – helped the committee determine that two ergonomic problems were causing 80% of the accidents/injuries and illnesses. The first problem was leg pain and falls in the processing area where employees stand for long periods of time on hard tile floors. Anti-
fatigue mats were needed. The committee tried four different brands to determine which one was perceived to be the most comfortable and then purchased the mat that was not only comfortable but also guaranteed for 10 years. Although the mat purchased was more costly than the others in the study, none of the other mats were guaranteed for more than two years so the committee compared the cost per year in their proposal. Another problem was lower back pain and knee pain in all areas of the laboratories due to old chairs that were not adjustable. Eight chairs from different vendors were evaluated over a six-month period of time. The chair selected had a larger seat pan than the old one and more support for the back. In addition, the chairs were fully adjustable for height, pan tilt and back tilt. Part of the contract for the new chairs included training of employees on all three shifts seven days per week by the manufacturer’s representative on the proper adjustment of the chairs. This way, employees got personalized attention on how to adjust their chair prior to starting their work shift. This was especially important to areas where chairs were shared.

Another useful tool is a workstation checklist, which should include but is not limited to the following:

1. Does the working space allow for a full range of work movements?
2. Are the mechanical aids and equipment provided where feasible?
3. Is the work surface height proper and adjustable?
4. Can the work surface be tilted or angled if necessary?
5. Is the workstation designed to minimize or eliminate:
   - twisting at the waist?
   - reaching above the shoulder?
   - bending at the waist?
   - extension of the arms?
   - bending or twisting of the wrist?
   - elevation of elbows?
6. Do the employees have the option to vary their posture?
7. Are the employees’ hands or arms subjected to pressure from sharp edges on the work surface?
8. Is an armrest provided where needed?
9. Is a footrest provided where needed?
10. Is the floor surface irregular, slippery, or sloping?
11. Are cushioned floor mats provided for workers who are required to stand for long periods?
12. Where chairs or stools are provided, are they easily adjustable and suited to the task?
13. Is the workplace temperature too hot or too cold?
14. Are all task requirements visible from comfortable positions?
15. Is there a preventive maintenance program for mechanical aids, tools, and other equipment?

All risk factors within an area should be identified and proper controls implemented to eliminate each of them. The idea of an ergonomic approach is to make things better than they were before, with incremental improvements in reducing or eliminating some, if not all, risk factors.
Where feasible, hazards are prevented by effective design of the laboratory. CLSI published a new standard on Laboratory Design (2016) which should be of help to anyone involved in remodeling or designing a new lab. Engineering controls are the preferred means of controlling or reducing ergonomic hazards in the workplace. Workstations should be designed so that it accommodates the specific worker who uses it, not just the “average” worker. A laboratory is ergonomically correct when pain is not experienced while performing tasks. The height of tables and chairs should be adjustable to provide proper back and leg support. Workstations should allow sufficient space for the knees and feet. When seated, the width clearance must be at least 27 inches and the depth clearance must be at least 18 inches at the knees and 45 inches at the feet for sufficient comfort.

Computer keyboards can be adjusted so they are near or below elbow level with the mouse on the same plane as the keyboard. Modular furniture that can be adjusted for employee height is beneficial. An adjustment range of at least 11 inches is recommended in order to allow for individual differences in body height.

Proper seating should be made available to employees whenever possible. The backrest should support the lower back and tilt to allow for some movement while working. It is also a good idea to remove a wallet or any other items from the back pocket as it can cause the hips to tilt putting a strain on the muscles in the back as well as the hips and spine. Seat cushions can be used to compensate for height variation. The shoulders should be relaxed to allow a neutral position with the forearm at a 90° angle to ensure good circulation. If armrests are used, they should not be so high as to force the shoulders up and pinch the neck. The chair should have a padded seat with the proper width and depth to allow the knees to bend at 90° with the feet flat on the floor or on a footrest. This will ensure proper circulation. A proper chair with four or six way adjustment levers can increase productivity by 25%. Too many adjustment features, however, can cause the employee to use them incorrectly or not at all. Chairs used in the laboratory on tile floors should have five legs, soft casters, and no arms and be made of material that can be cleaned and disinfected easily (e.g.: vinyl). Chairs in a non-biohazard area can have other types of material. If the floor has carpet, hard casters must be used. Footrests help to reduce stress and fatigue for shorter employees.

Proper work height can be adjusted by either lowering the work surface or raising the employee to the work surface. Maximum reaching should be between 14 and 16 inches. A workstation that allows the employee’s arm or hand to come in contact with a hard or sharp edge can cause damage to the tissues, including nerve or blood vessel damage. Rounding edges, padding edges or relocating equipment can solve this problem. Tile floors can be covered with anti-fatigue mats for workstations where long periods of standing are required.

When working with a computer monitor, the eyes should be at least 19-36 inches away from the monitor depending on the individual’s focal length and the size of the monitor. Tilting the monitor, using an anti-glare screen over the monitor or adjusting the overhead lights can lessen glare off computer monitors. Also, every 15 minutes, the employee should look away from the monitor and focus on something else to help eyes stay healthy. The head should be straight or tilted downward slightly. The top-most line of the display screen should never be
higher than eye level. The document holder should be directly next to the display screen to minimize eye, neck, and back movement. For proper computer workstation set-up see Figure 2.

Equipment should be on movable procedure tables if access to the back is required for maintenance. Depth of laboratory counters should accommodate standard laboratory equipment. A good workstation layout will facilitate the flow of laboratory testing.

A phlebotomy cart that can hold a phlebotomy tray as well as point-of-care instruments and other equipment needed by the new patient care technician job classification is a good example of proactive ergonomic thinking. Equipment and supplies should have a definite and fixed space for storage. Equipment controls should be easy to reach and equally accessible for both right- and left-handed employees.

After employees are trained in a particular task, supervisors should ensure that work practice controls are maintained by monitoring employees and improper practices should be promptly corrected to prevent injury. This monitoring can become a part of the laboratory’s quality assurance program. Some facilities have initiated exercise periods for employees at the beginning of and throughout a shift to prevent injuries and to promote wellness.

Personal protective equipment should be selected with ergonomic stressors in mind so that the equipment reduces rather than contributes to the hazards. Equipment should be designed to fit the employee rather than forcing the employee to fit the equipment.

Administrative controls reduce the duration, frequency, and severity of exposure to ergonomic hazards. Examples include job rotation to allow use of different muscle-tendon groups, frequent breaks to reduce stress and strain, and increasing the number of employees assigned to a task where work conditions are severe. In addition, a preventive maintenance program for equipment to verify proper working order is essential. An effective housekeeping program to minimize slippery work surfaces and related hazards such as slips and falls because of clutter is essential.

Medical management can help to eliminate or reduce the risk of ergonomically related problems and symptoms through early identification and treatment. It is estimated that CTD victims lose an average of 30 workdays per injury. Sit down jobs restrict blood circulation, preventing muscles from getting the nutrients they need and eliminating waste products such as lactic acid. Ironically, lack of movement can provoke the same joint injuries that afflict athletes. For example, bending over a keyboard or a lab bench all day puts pressure on the tendons of the shoulder, which can lead to a torn rotator cuff in later years. Slumping puts pressure on the lower spine, and sitting still and crossing one’s legs causes edema of the lower extremities. This swelling then prompts the heart to work harder and blood pressure to rise. In one case, a facility reduced its workers compensation claims by $90,000 in just one year by implementing workstation redesign.

Training and education go a long way toward increasing safety awareness. Training allows supervisors and employees to understand ergonomic and other hazards associated with a job, their prevention and control, and their medical consequences. Several medical facilities in
California require worksite evaluation for new employees prior to starting a job. Suggestions and input from workers who are educated about ergonomic hazards can be very helpful in designing improved work practices to reduce those hazards. A good ergonomics education and training program will teach employees how to use equipment properly and the correct way to do a variety of job tasks. Helping to identify habits such as arching the neck while wearing bifocals so that one can peer at a computer screen through the lower lenses and cradling the telephone between the head and shoulder rather than using a headset or telephone rest to alleviate ergonomic stresses is helpful. Photographs or videos of employees at their workstation before and after evaluation and adjustment are a visual tool that can be used for training as well.

Ergonomics is also finding its way to the World Wide Web. Check out the following web pages for more information:

- [http://www.osha.gov/SLTC/ergonomics](http://www.osha.gov/SLTC/ergonomics)
- [http://www.cdc.gov/niosh/topics/ergonomics](http://www.cdc.gov/niosh/topics/ergonomics)
- [http://www.ergoweb.com](http://www.ergoweb.com)

References

**Figure 1**

**Ergonomic Symptoms Survey Checklist**

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<th>Shift:</th>
<th>Hours worked/week:</th>
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<th>Have you had any pain or discomfort during the last year?</th>
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Check the areas:
- Neck: [ ]
- Shoulder: [ ]
- Elbow/forearm: [ ]
- Hand/wrist: [ ]
- Fingers: [ ]
- Upper Back: [ ]
- Lower Back: [ ]
- Thigh/knee: [ ]
- Lower Leg: [ ]
- Ankle/foot: [ ]

Put a check by the word(s) that best describe your problem:
- Aching: [ ]
- Burning: [ ]
- Cramping: [ ]
- Loss of Color: [ ]
- Numbness (asleep): [ ]
- Pain: [ ]
- Swelling: [ ]
- Stiffness: [ ]
- Tingling: [ ]
- Weakness: [ ]

Other:

When did you first notice the problem?

How long does each episode last?

What do you think caused the problem?

Have you had this problem in the last 7 days?

Have you had medical treatment for this problem?

If no, why not?

If yes, where did you receive treatment?

Did the treatment help?

How much time have you lost in the last year because of this problem? _____ days

Please comment on what you think would improve your symptoms:
Figure 2
REVIEW QUESTIONS
DL-906
Circle the one best answer.

1. What percent of all injuries reported does OSHA expect to attribute to CTD?
   a. 50
   b. 70
   c. 60
   d. 80

2. Which one of the following is NOT an ergonomic illness:
   a. tendonitis
   b. hepatitis
   c. carpal tunnel syndrome
   d. back disorders

3. A laboratory is ergonomically correct when pain is experienced while performing tasks:
   a. True
   b. False

4. When adjusting your chair, you should make sure the:
   a. arm rests are adjustable
   b. backrest supports the lower back and is firmly in place
   c. seat pan tilts to allow movement while working
   d. backrest supports the lower back and tilts to allow some movement while working

5. When you adjust your workstation chair your arm should be at a:
   a. 45° angle
   b. 90° angle
   c. 120° angle

6. The computer monitor should be _______ from your eyes.
   a. at your focal length
   b. 25 inches
   c. 27 inches

7. An administrative control is a:
   a. job consolidation
   b. job transfer
   c. job elimination

8. Maximum arm reach is:
   a. 10-12 inches
   b. 14-16 inches
   c. 12-14 inches
   d. 16-24 inches
9. What is the best work practice control for employees who must stand for long periods of time?
   a. comfortable shoes
   b. anti-fatigue mats
   c. shorter work hours

10. Monitoring work practice controls can be part of the laboratory’s
    a. ergonomics control program
    b. quality assurance program
    c. quality control program

11. What is the average number of workdays per injury that CTD victims lose?
    a. 20
    b. 25
    c. 22
    d. 30

12. What one activity can you do every hour to prevent repetitive motion injuries?
    a. take a drink of water
    b. prop your feet up
    c. exercise/rest

13. When do employees often experience symptoms of carpal tunnel syndrome?
    a. during off duty hours
    b. at work
    c. at a meeting
    d. during meal breaks

14. California OSHA passed an ergonomic standard called the:
    a. Repetitive Motion Injuries Standard
    b. Carpal Tunnel Standard
    c. Repetitive Hand Motion Standard
    d. Upper Extremity Relief Standard

15. The California OSHA ergonomic standard is for businesses with ____ or more employees.
    a. 10
    b. 25
    c. 15
    d. 50

16. Using a trigger operated pipette in place of a thumb operated pipette is a/an:
    a. Administrative Control
    b. Personal Protection Control
    c. Work Practice Control
    d. Engineering Control
17. The key to motivating employees to act safely and avoid ergonomic illnesses is:
   a. commitment by management
   b. safe policies and procedures
   c. an autocratic management team
   d. financial incentives

18. Exhausted muscles require ____ minutes rest to achieve 90% recovery.
   a. 15
   b. 45
   c. 30
   d. 60

19. The height of a footrest is measured from the:
   a. sole of the foot to the floor
   b. ankle of the foot to the floor
   c. end of the big toe to the back of the heel
   d. ball of the foot to the back of the heel

20. Chairs used in the laboratory on tile floors should have:
   a. five legs, soft casters and no arms
   b. five legs, hard casters, and no arms
   c. five legs, soft casters, with arms
   d. five legs, hard casters, with arms