UNIVERSITY OF ROCHESTER

Ergonomics Program

Prepared by:

THE OCCUPATIONAL SAFETY UNIT of
ENVIRONMENTAL HEALTH & SAFETY

Revised 2/2018

TABLE OF CONTENTS

INTRODUCTION

The University of Rochester Ergonomics Program has been established to reduce the number and severity of Work-Related Musculoskeletal Disorders (WRMSDs) caused or contributed to by exposure to ergonomic stressors in the workplace.

Musculoskeletal Disorders (MSDs) are injuries caused by overexertion, overuse or excessive repetition involving muscles, nerves, tendons, ligaments, cartilage, joints and spinal disks. Other commonly used terms for these types of injuries include cumulative trauma disorders (CTDs) and repetitive strain injuries (RSIs).

The U of R Ergonomics Program is intended to provide guidance in the identification of ergonomic hazards and the implementation of controls that will reduce the potential for injury due to those hazards. It is the policy of the University of Rochester to provide an environment free from recognized hazards that could cause injury or illness.

Ergonomics is defined as the study of the interaction between the worker and his/her work environment, with the objective of fitting the workplace and tasks to the worker. The primary tools of UR's Ergonomic Program are:

- Worksite evaluations
- Employee and supervisor training
- Implementation of ergonomic control strategies

Ergonomics should not be seen as a one-time effort, but as a continuous, on-going process used to optimize the working environment.

One of the key aspects of the ergonomics program is identifying and educating employees who are at high risk of developing MSDs. Early identification of symptoms with prompt intervention helps prevent escalation of minor discomfort into more serious or chronic injuries. Training on the following subjects is available through MyPath as well as Occupational Safety or the Center for Nursing Professional Development:

- General Ergonomics
- Office Ergonomics
- How to Reduce Ergonomic Risk Factors
- Fitting the Workplace to the Worker
- Back Safety/Safe Manual Material Handling Strategies
- Safe patient handling

The University's Ergonomics Program is divided into two sections. Section 1 outlines the manner in which the University is working to minimize ergonomic-related injuries through management leadership, employee participation, job hazard analysis, training, program evaluation, and defining responsibilities. Section 2 focuses on processes for minimizing ergonomic hazards.

SECTION 1: MINIMIZING ERGONOMIC-RELATED INJURIES

I. Minimizing Ergonomic-Related Injuries Though Management Leadership, Employee Participation, Job Hazard Analysis, Training and Program Evaluation:

A. Management leadership, as demonstrated by an effective MSD reporting system and prompt responses to reports, clear program responsibilities, and regular communication with employees about the program:

The University has an effective MSD reporting system through employee incident reports and follow-up procedures. Communication of the Ergonomics Program is provided through training sessions, new hire training, participation in employee health and wellness fairs, articles in the University's internal news publications, and other resources such as the EH&S web page and pamphlets.

B. Employee participation, as demonstrated by the early reporting of MSDs and active involvement by employees and their representatives in the implementation, evaluation, and future development of the ergonomics program.

When employees experience an MSD sign or symptom, it is reported to their supervisor. Staff is involved with the selection and implementation of ergonomically designed equipment including furniture, carts, tools and lifting equipment.

C. Job hazard analysis and control, as demonstrated by a process that identifies, analyzes, and to the extent possible, reduces or controls ergonomic hazards using feasible engineering, work practice, and administrative controls to levels below those prescribed in the hazard identification tools.

Workplace assessments are performed to identify potential ergonomic hazards. When hazards are noted, engineering controls are implemented by correctly locating or adjusting the components of the workplace and by recommending the use of ergonomically designed equipment as appropriate. Work practice controls are implemented by alternating repetitive tasks and administrative controls are implemented by job rotation.

D. Training of managers, supervisors, and employees (at no cost to these employees) in the ergonomics program and their role in it; the recognition of MSD signs and symptoms; the importance of early reporting; the identification of ergonomic hazards in the workplace, and the methods to control them:

Training is provided to staff members at no cost through such programs as New

Hire Orientation, MyPath on-line training, on-request ergonomics training provided by EH&S, workstation assessments conducted by the EH&S Occupational Safety Unit at no cost to the employee or his/her department (however, any recommended equipment must be purchased by the employee's department), pamphlets, and the EH&S web page. These training tools educate staff about the signs and symptoms of MSDs and the importance of early reporting.

E. Program evaluation, as demonstrated by regular reviews of the elements of the program and of the effectiveness of the program as a whole, using such measures as reductions in the number and severity of MSDs, increases in the number of jobs in which ergonomic hazards have been controlled, or reductions in the number of jobs posing ergonomic hazards to employees; and the correction of identified deficiencies in the program;

Occupational Safety tracks MSD incidents through review of employee incident reports to determine how, when and where MSDs are occurring. These are reviewed on an ongoing basis, and problem areas are addressed using engineering, administrative and work practice controls. The U of R does not have policies or procedures that discourage employees from participating in the program or reporting the signs or symptoms of MSDs or the presence of ergonomic hazards in the workplace.

II. Responsibilities:

All U of R staff and faculty members are responsible for contributing to a safe and healthy work place. Employees are encouraged to review information and to participate in education and training opportunities that can enable them to contribute to a healthy work environment. Since non-work activities can cause or contribute to discomfort and/or injuries, employees are urged to apply ergonomic principles outside the workplace as well.

A. Managers:

Managers play a leading role in the implementation of strategies to control MSDs in the workplace.

This includes:

- Learning about MSD causes and control options;
- Providing resources to implement ergonomic solutions and remediation;
- Performing or requesting periodic risk assessments to identify ergonomic hazards;

- Purchasing furniture that has maximum adjustment flexibility and complies with standards established by the American National Standards Institute (ANSI) and UR furniture guidelines;
- Developing procedures to respond to employee concerns about MSD problems;
- Restructuring job tasks to reduce risk factors which contribute to MSDs;
- Encouraging supervisors to implement steps to control MSDs in the workplace;
- Providing training to supervisors and employees.

B. Supervisors:

Supervisors must provide employees with appropriate ergonomics training, reinforcement, assistance, and evaluations (where appropriate). There are several ways this can be accomplished:

- Promoting a safe and healthy work environment;
- Maintaining an awareness of ergonomic risk factors;
- Having the work environment appropriately evaluated for proper ergonomic practices and conditions;
- Providing proper workstations and assistive devices;
- Promptly reporting all employee injuries and/or employee complaints regarding repetitive motion or overuse injury symptoms;
- When necessary, seeking assistance from Occupational Safety regarding ergonomic issues;
- Providing adequate recovery time by allowing employees engaged in highly repetitive tasks the opportunity for frequent, short, breaks and alternative work activities;
- Integrating ergonomics into total department safety management.

C. Employees:

Employees must promptly report ergonomic problems to their supervisors. Prompt implementation of workplace changes can significantly reduce the potential for severe injuries or illnesses. Employees are required to:

- Report work-related MSD signs and symptoms to their supervisor;
- Follow safe work practices;
- Make effective use of recovery periods;
- Follow ergonomic recommendations;
- Adjust and use their workstation and equipment as outlined in the ergonomic guidelines (see appendices).

D. Occupational Safety Unit (OSU):

- Coordinates the ergonomics program to reduce ergonomic-related injuries at UR;
- Provides guidance on modifying the workplace to minimize the potential for injuries and illnesses;
- Provides ergonomics training for employees, supervisors, and managers;
- Analyzes and reports trends in injury or incidence, and severity;
- Reviews employee incident reports on an ongoing basis to track MSDs;
- Evaluates individual and departmental workstations;
- Provides assistance and advice on the selection of ergonomically appropriate furniture and equipment.

E. Human Resources Department:

The Human Resources Department manages the Workers' Compensation Insurance and Return to Work Programs. The Return to Work (RTW) Program is designed to help University employees reach full recovery following illness or injury by providing timely and appropriate treatment while the employee continues in worthwhile and meaningful work. The goal of the RTW Program is to return the employee within 60 days or as soon as his or her condition permits. Refer to University Policy # 271 for Workers Compensation Benefit and Return to Work Program guidelines.

F. University Health Service and Occupational Medicine

Reserved

G. UR Purchasing Department:

The UR Purchasing Department and Occupational Safety can provide assistance and advice on the procurement of ergonomically appropriate furniture and equipment. Purchasing can be reached at 275-2002.

SECTION 2: MINIMIZING ERGONOMIC HAZARDS

I. Awareness of Musculoskeletal Disorders (MSDs):

Signs and symptoms of MSDs of the upper extremities may include pain, numbness, or tingling of the fingers, wrists, elbows, or shoulders. Chronic back and neck problems may result in pain, numbness, or tingling that radiates to the arms or legs, as well as limited back motion.

Back pain and other ergonomically-based symptoms can result from acute injury due to a single overexertion incident, or may result from cumulative trauma due to chronic overexertion, improper work practices, or poor working postures. Cumulative trauma may be exacerbated by inadequate work-rest cycles.

II. Preventive Actions:

Reducing the risk of MSD problems can be achieved by:

- Evaluating the workplace to identify MSD risk factors;
- Encouraging employee awareness and providing education;
- Using ergonomically appropriate work practices;
- Making ergonomically sound workplace adjustments;
- Properly using ergonomically designed tools and furniture (i.e., providing flexibility for adjustments and allowing for proper individual posture);
- Performing five minutes of alternative work activity for every 30 minutes of continuous, high intensity, repetitive work (for example: after two hours of continuous keyboarding, devoting 15 minutes to non-repetitive motion activities like returning phone calls or filing);
- Seeking evaluation and intervening as soon as symptoms of MSD occur;
- Using proper lifting techniques;
- Obtaining assistance or using mechanical lifting devices for tasks that exceed an individual's capabilities.

III. Early Intervention:

Early intervention is essential to the long-term prevention of and quick recovery from MSDs. It is extremely important for employees to report any MSD symptoms as soon as possible. MSDs usually develop gradually; symptoms such as pain, numbness, and tingling in the upper extremities are often ignored until the condition becomes chronic or permanent injury occurs. Employees experiencing symptoms are encouraged to contact their supervisor or Occupational Safety to schedule an ergonomic evaluation.

IV. Workplace Evaluations:

The ergonomics program and services described in these guidelines are applicable to all persons working at UR. Priority will be given to employees with reported MSD symptoms, employees with diagnosed MSDs, and employees who work in identified high-risk jobs or departments. Occupational Safety Unit staff members are available to help with evaluating and redesigning workstations, tasks, and work practices. An ergonomic self-assessment should be completed prior to calling EH&S at 275-3241 to schedule an appointment for a workstation evaluation. See the EH& S webpage regarding help with ergonomic concerns - https://www.safety.rochester.edu/safetyinfo/helpwithergoconcerns.html for further information. Note: it is recommended that an employee requesting an ergonomic assessment speak with his/her supervisor before making the appointment.

V. Reporting:

Employees experiencing signs and symptoms of MSDs need to promptly report them to their supervisor. Employees should file online incident reports to ensure proper notifications are made for Worker's Compensation and EHS. Employees are encouraged to go to University Health Service (UHS) or Occupational Medicine for an evaluation. This does not preclude employees from going to their own Health Care Professional (HCP).

VI. Training:

Upon new hire, employees will be trained on sound ergonomic principles and practices. Information regarding sound ergonomic principles is presented as part of the annual safety training (mandatory for all employees). Occupational Safety can provide individual education during work site evaluation or on request.

VII. Record keeping:

Records of employee reports of MSDs, MSD signs and symptoms, ergonomic hazards, responses to such reports, workstation assessments, hazard control measures and records of work restrictions and the HCP's (Health Care Professional) written opinion are kept on file under the Worker's Compensation Program of the UR. Employees and, with written permission, their representatives, are provided with access to these records.

APPENDICES

The appendices provide guidelines for proper body mechanics and information to assist in developing an ergonomically sound workstation. The appendices cover VDT workstation set-up, patient care lifting and transfer guidelines, hand tool ergonomics, laboratory ergonomics, manual material handling guidelines, information on sit/stand workstations and guidance for purchasing furniture and accessories.

APPENDIX I

Video Display Terminal (VDT) Workstation Guidelines

Chair: Chairs should have an adjustable back (height and angle) to provide support for the user's back, especially in the lumbar region. High-back chairs provide extra support for the upper back and neck. Chairs should have easily adjustable seat height, which should be adjusted to permit the feet to rest flat on the floor with the upper legs parallel to the floor. A footrest may be needed by some people to achieve this position if the work surface is too high and is not height adjustable. Chairs should have a five-star base for stability and casters compatible with the floor surface (hard casters for carpeted surfaces and rubberized casters for use on hard floor surfaces). Well-padded T-armrests with adjustable height and width are recommended for intensive computer users. To prevent contact stress when the user is seated, the front edge of the seat pan should not contact the back of the lower legs behind the knees.

Work Surface: Work surfaces should be large enough to accommodate all necessary equipment and provide proper viewing distance between the monitor and operator's eyes. An adjustable keyboard platform should be used to increase depth and to provide proper keyboard angle and height. The edges of work surfaces should be rounded or padded to minimize contact stress on the hands, wrists, forearms, and elbows. There should be enough room under the work surface to allow free leg movement. The height of the work surface should allow the forearms to be parallel with the floor when working at the computer, while not forcing the shoulders to be elevated. If the work surface is too high and the chair seat must be raised to match, a footrest can assist in supporting the feet as well, allowing the employee to sit back in his/her chair.

Keyboard/Input Device: The keyboard and pointing device (mouse or trackball) should be at the same level and directly in front of the operator. The height of the keyboard and input device should allow the operator to position the forearms and hands parallel to the floor with the fingertips resting on the home row keys. This can be achieved by using an adjustable keyboard platform or by adjusting the height of the chair and/or table. A padded wrist rest for the keyboard and input device should be used to prevent the operator's wrists from coming in contact with the work surface when the arms are at rest. Users should avoid overreaching by keeping input devices close to the body.

Monitor (Terminal): Computer monitors should be positioned directly in front of the operator, at a comfortable viewing distance, with the top of the screen approximately at eye level. Those wearing bifocals or other multi-vision glasses may prefer a slightly lower monitor height. When two monitors are used, they should be placed close together and their combined screen area should be centered in front of the seated work position if they are used equally; if one monitor is used more than the other, it should be moved closer to center. Monitors should have good contrast, sharp focus, and be

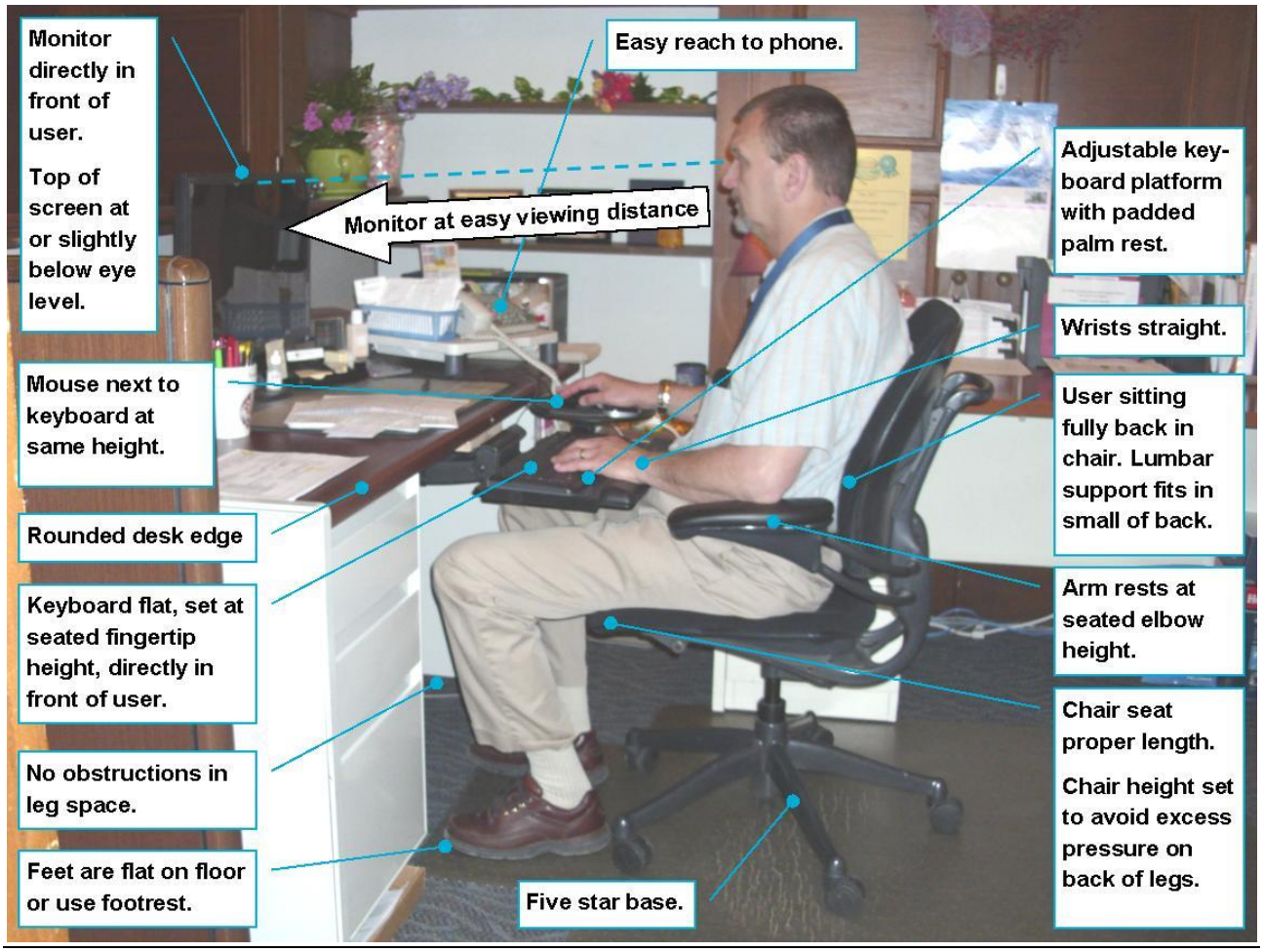
free from flicker and glare/reflections to minimize eyestrain. Direct glare—bright light from outside windows behind the monitor(s)—may also create eye strain.

Document Holder: Document holders should be located at eye level, close to the monitor and at the same height.

Phone Head Set: Headsets reduce awkward neck and shoulder postures, notably by eliminating the need to cradle the phone between the shoulder and chin. Headsets are particularly beneficial for people who use the telephone for long periods of time or work on the phone and computer or with paper documents simultaneously.

Lighting: Excessive overhead lighting can cause glare and eye discomfort. Dimming overhead lights and using a task lamp can reduce eye fatigue. Monitor shades and glare filters may also reduce glare. Monitor contrast and brightness should be adjusted for maximum personal comfort.

A Well-Designed Computer Workstation



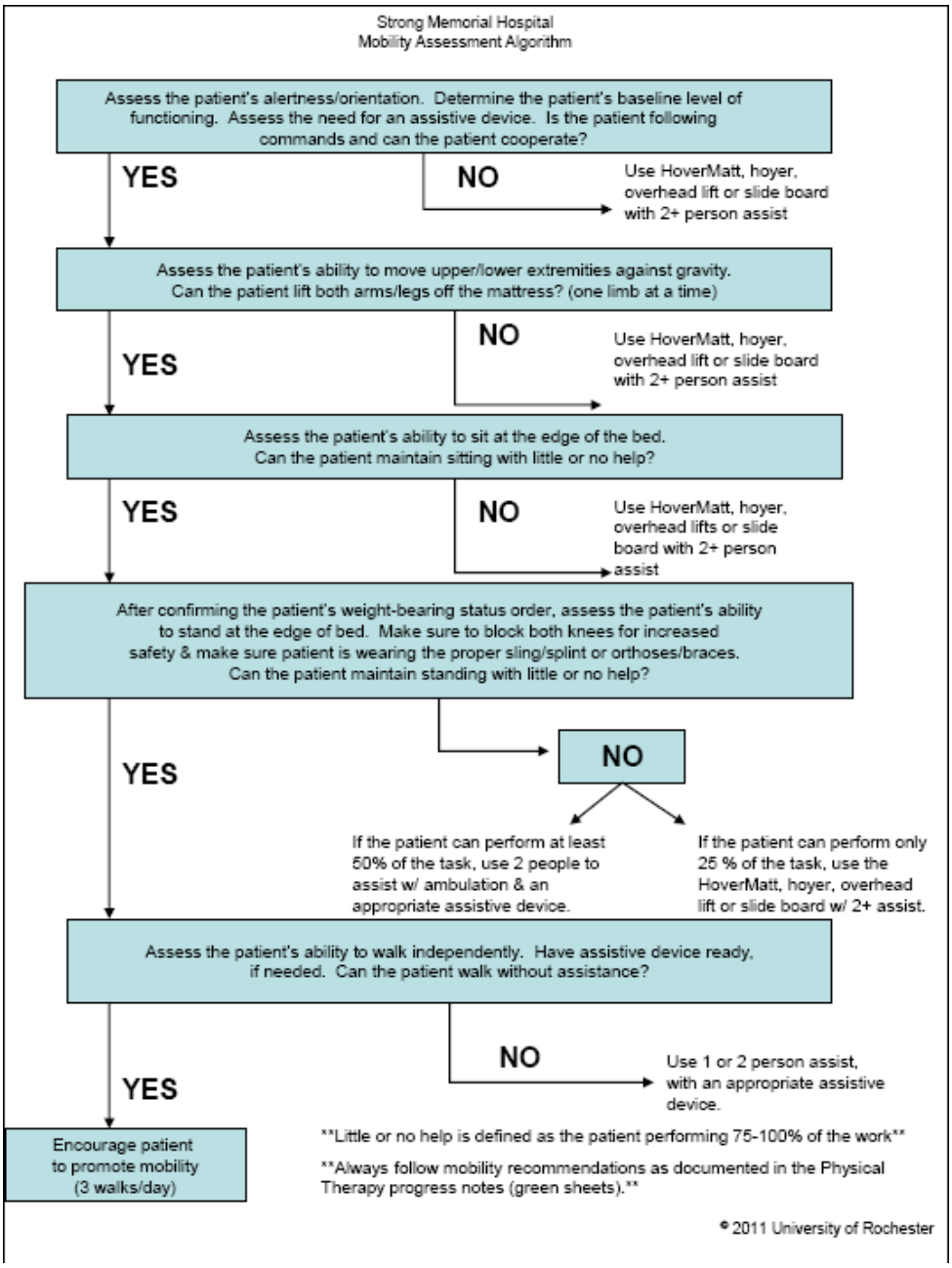
APPENDIX II

Patient Care Lifting Guidelines

Patient handling, including lifting, transferring, and repositioning, is covered by SMH Policy 10.22 Minimal Lift for Patient Handling, which can be found at:

http://sharepoint.mc.rochester.edu/sites/smhpolicy/Pol/Shared%20Documents/10.22%20Minimal%20Lift%20for%20Patient%20Handling.pdf

The following Mobility Assessment Algorithm, provided in the policy should be used to determine appropriate equipment and assist levels:



The decision tree can be found at:

http://intranet.urmc-sh.rochester.edu/Policy/smhpolicies/Section10/10-22%20Patient%20Decison%20Tree.pdf

Guidelines for Manual Lifting and Lateral Transfers

Use assistive equipment and devices whenever possible. Do not lift or move patients manually unless there is no feasible alternative. Get help from other staff. Tell patients what they can do to help you. Give them clear, simple instructions with adequate time for response.

Before lifting, transferring, or ambulating a patient, it is important to perform or obtain an accurate assessment of the patient's capabilities and to be aware of any factors, such as fatigue, dizziness, or confusion, which could adversely affect the patient's strength, stability, or ability to follow instructions.

Lifting

Whenever possible, mechanical safe patient handling devices (ceiling- or Hoyer-type lifts) should be used to lift patients. Manual lifting should not be performed unless use of a mechanical lift is medically contraindicated, there is immediate danger to the patient, or there is no feasible alternative.

When there is no feasible alternative to a manual lift, the patient is in immediate danger, or a mechanical lift is medically contraindicated, use upright, neutral working postures and proper body mechanics:

- Move obstructions out of the way before lifting.
- Bend your legs, not your back. Use your legs to do the work.
- When lifting or moving people, always face them.
- Never twist your back when lifting. If you must turn, pick up your feet and pivot your whole body in the direction of the move.
- Try to keep the person, equipment, or supplies you are lifting close to your body as you move.
- Keep handholds between your waist and shoulders.
- Move the person towards you, not away from you.
- Use slides and lateral transfers instead of manual lifting.
- Use a wide, balanced stance with one foot slightly ahead of the other.
- Lower the person slowly by bending your legs, not your back. Return to an erect position as soon as possible.
- Use smooth movements and do not jerk. When lifting with others, coordinate lifts by counting down and synchronizing the lift.

Lateral Transfers of Patients

- Position surfaces (e.g., bed and gurney, bed and cardiac chair) as close as possible to each other. Surfaces should be at approximately waist height, with the receiving surface slightly lower to take advantage of gravity.
- Lower the rails on both surfaces (e.g., beds and gurneys).
- Use lateral air transfer devices whenever possible.
- Use draw sheets or incontinence pads in combination with friction-reducing devices (e.g., slide boards, slippery sheets, plastic bags, low-friction mattress covers, etc.).
- Get a good handhold by rolling up draw sheets and incontinence pads and use other assistive equipment such as slippery sheets with handles.
- Kneel on the bed or gurney to avoid extended reaches and bending of the back.
- Have team members on both sides of the bed or other surfaces. Count down and synchronize the lift. Use a smooth, coordinated push-pull motion. Do not reach across the person you are moving.

Guidelines for Ambulating, Repositioning and Manipulating

These work tasks are usually performed in or around beds, gurneys, chairs, toilets, showers and bathtubs. Equipment commonly used includes gait or transfer belts with handles (for better grips and stability), pivot discs, draw sheets, and incontinence pads.

Using Gait or Transfer Belts with Handles for Patient Maneuvering

- Keep the individual as close as possible.
- Avoid bending, reaching or twisting your back when:
  - attaching or removing belts (e.g., raise or lower beds, bend at the knees)
  - lowering the individual
  - assisting with ambulation
- Pivot with your feet to turn.
- Use a gentle rocking motion to take advantage of momentum.
- Be aware of any signs that the patient is becoming fatigued, unstable, or confused.

Performing Stand-Pivot Type Transfers

- Used for transferring from bed to chair, etc., or to help an individual get up from a sitting position.
- Use transfer discs or other assistive devices when available. If using a gait or transfer belt with handles, follow the above guidelines.
- Keep feet at least shoulder width apart.

- If the patient is on a bed, lower the bed so that they can place their feet on the floor to stand.
- Place the receiving surface (e.g., wheelchair) on the individual's strong side (e.g., for stroke or hemi-paralysis conditions) so they can help in the transfer.
- Get the patient close to the edge of bed or chair and ask them to lean forward as they stand (if medically appropriate).
- Block the individual's weak leg with your legs or knees (this may place your leg in an awkward, unstable position; an alternative is to use a transfer belt with handles and straddle your legs around the weak leg of the patient or resident).
- Bend your legs, not your back.
- Pivot with your feet to turn.
- Use a gentle, rocking motion to take advantage of momentum.

Lifting or Moving Tasks with the Patient in Bed

Some common methods include boosting up or repositioning individuals using draw sheets and incontinence pads in combination with a log roll or other techniques. Whenever possible, safe patient handling devices such as ceiling lifts equipped with repositioning slings, other mechanical lifting devices, lateral air transfer devices/hover mats, or slip sheets should be used.

- Adjust beds, gurneys or other surfaces to waist height and as close to you as possible.
- Lower the rails on the bed, gurney, etc., and work on the side where the individual is closest.
- Place equipment or items close to you and at waist height.
- Get help and use teamwork.

Guidelines for Transporting Patients and Equipment

It is often necessary to transport patients in gurneys, wheelchairs, or beds, or handle various types of carts, monitors, instrument sets, and other medical equipment.

- Decrease the load or weight of carts, instrument trays, etc.
- Store items and equipment between waist and shoulder height.
- Use sliding motions or lateral transfers instead of lifting.
- Push, do not pull. Keep loads close to your body. Use an upright, neutral posture and push with your whole body, not just your arms.
- Move down the center of corridors to prevent collisions.
- Watch out for door handles and high thresholds, which can cause abrupt stops.
- Promptly take out of service any rolling equipment that is defective or in need of maintenance and tag with a description of the problem. Report it to the appropriate department.

Guidelines for Performing Activities of Daily Living

Cramped showers, bathrooms or other facilities in combination with poor work practices may cause providers to assume awkward positions or postures or use forceful exertions when performing ADLs.

- Use upright, neutral working postures and proper body mechanics. Bend your legs, not your back.
- Eliminate bending, twisting and long reaches by:
  Using long-handled extension tools (e.g., hand-held shower heads, wash and scrub brushes).
- Wheel people out of showers or bathrooms and turn them around to wash hard-to-reach places.
- Use shower-toilet chairs, which are high enough to fit over toilets. This eliminates additional transfers to and from wheelchairs, toilets, etc.
- Use shower carts or gurneys, bath boards, pelvic lift devices, bathtub and shower lifts, and other helpful equipment.
- When providing in-bed medical care or other services, use the guidelines above.

Guidelines for Transferring From the Floor

Lifting a patient from the floor is extremely hazardous. Unless medically contraindicated, or there is immediate risk to the patient, use a mechanical assist device such as a ceiling- or Hoyer-type lift, or Hover Jack to lift patients from the floor. If assistive devices are medically contraindicated, or are not readily available and waiting to obtain one would jeopardize the patient's safety or well-being, you may have to perform a manual lift. When placing slings, blankets, draw sheets or cots under the person:

- Position at least two providers on each side of the person. Get additional help for large patients or residents.
- Bend at your knees, not your back. Do not twist.
- Roll the person onto their side without reaching across them.
- If using hoists, lower the hoist enough to attach slings without strain.
- If manually lifting, kneel on one knee, grasp the blanket, draw sheet or cot. Count down and synchronize the lift. Perform a smooth lift with your legs as you stand up. Do not bend your back.

Guidelines for Assisting in Surgery

- Use retractor rings instead of prolonged manual holding of retractors.
- Position operating tables or other surfaces at waist height.

- Stand on lifts or stools to reduce reaching.
- Frequently shift position or stretch during long operations.
- Avoid prolonged or repeated bending of the neck or the waist. Stand with one foot on a lift and frequently alternate feet to reduce pressure on the back.
- Reduce the number of instrument sets (trays) on a case cart.
- Store instrument sets (trays) in racks between the waist and shoulders.
- Use stands or fixtures to hold extremities.
- Get help from coworkers as needed to:
    - Position legs or upper extremities in stirrups;
    - Move heavy carts, microscopes, and monitors,
    - Alternate operating tables, equipment, or fixtures.

(Reprinted with permission from "A Back Injury Prevention Guide for Health Care Workers",Cal/OSHA Consultation Service, 1997)

APPENDIX III

Hand Tool Ergonomics

Proper attention to selection, design, and layout of tools can help minimize the risk of developing repetitive motion injuries. Seven basic principles can be applied when working with hand tools:

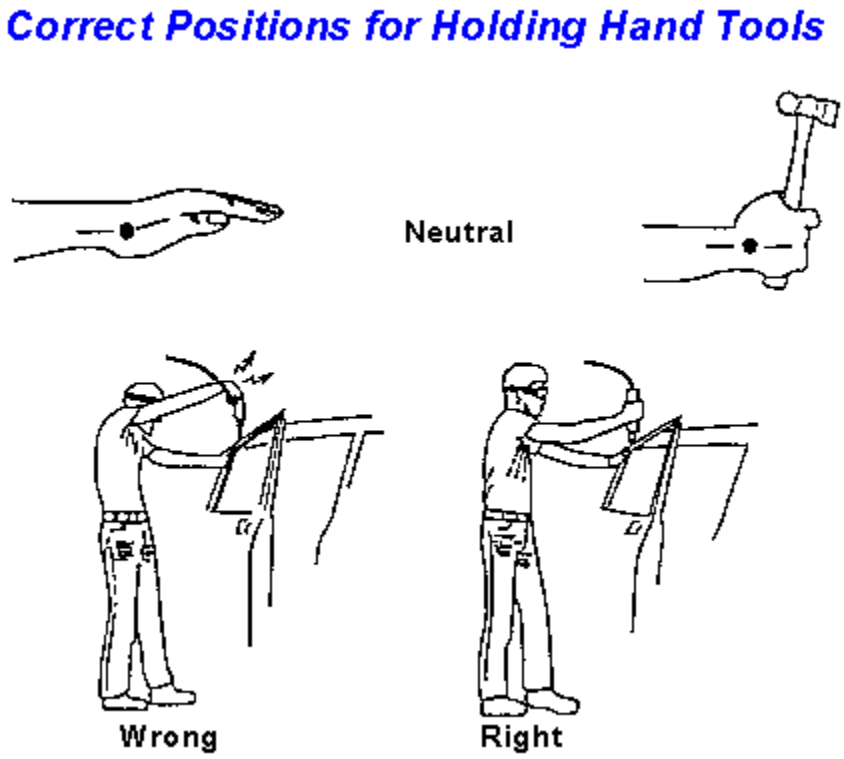
- Avoid applying excessive force
- Avoid high contact stress (localized pressure due to contact with a hard surface)
- Avoid static exertions (prolonged muscle tension)
- Avoid extreme or awkward postures and joint positions (i.e., bent wrist position)
- Avoid repetitive finger action
- Avoid tool vibration (select power or pneumatic tools with built-in vibration dampening whenever possible)
- Avoid prolonged work in extreme cold

The following guidelines can help with the selection and design of tools.

- Handles should be provided whenever possible. A properly designed handle isolates the hand from contact with the tool surface, enhances tool control, and increases mechanical advantage while reducing the amount of required exertion. Tool handles should be non-porous, non-slip, and non-conductive.
- Soft coverings on a tool handle protect the hands from heat and cold and help reduce pressure points and slipperiness of the grip.
- Select hand tools that fit the hands of the worker. A tool that is too large or too small will produce stress in the hand and wrist. As a rule of thumb, the ideal handle diameter is 1.5 inches for males, and 1.3 inches for females. It should be noted that these dimensions may not apply for individuals having very large or very small hands.
- Tools with a pistol grip should be used where the tool axis must be horizontal (parallel to the forearm). A straight grip should be used where the tool axis is vertical, or where the direction of force is perpendicular to the work plane (perpendicular to the forearm). Bent tool grips allow the wrist to maintain neutral postures.
- For trigger-activated tools, choose a grip that is smooth, free of sharp edges, is easily activated, and does not require forceful gripping. Forceful activation or gripping of tools having hard or sharp edges can lead to swelling of the tendon sheaths and may cause *trigger finger*.
- Many commercially available tools are designed for right hand use. Ideally, tools should be symmetrical or easily altered so they can be used by either the right or left hand.

- The provision of automatic spring opening on tools such as scissors and pliers will enable the worker to minimize use of the weak hand-opening muscles.

Correct positions for holding hand tools are illustrated below:



APPENDIX IV

Laboratory Ergonomics

Reprinted with permission from Fisher Scientific

The Pressure of Pipetting

Pipetting involves several ergonomic stressors - force exerted by the thumb, repetitive motions and awkward postures, especially of the wrists, arms, and shoulders. And these can be exacerbated by mental pressure resulting from the need for accuracy, precision, and timing demanded by many pipetting procedures. When pipetting is done for more than 300 hours in a year, the prevalence of hand and shoulder pain increases.

Recommended Protective Measures for Pipetting

- Rotate pipetting tasks among several people.
- Take short micro-pauses of a few seconds, when you can't take a longer break.
- Use only the force necessary to operate the pipetter.
- Choose pipetters requiring the least pressure.
- Work with arms close to the body to reduce strain on shoulders.
- Keep head and shoulders in a neutral position (bent forward no more than 30 degrees).
- Use adjustable chairs or stools with built-in solid footstools. Don't use a foot ring, which could compress blood vessels in feet, and don't use high stool which can force you to work with a bent neck.
- Don't elevate your arm without support for protracted periods.
- Use shorter pipettes. This decreases hand elevation and consequent awkward postures.
- Use low profile waste receptacles for used tips. They should be no higher than the top of the tubes being filled.

Microscope Use

Using a microscope involves several ergonomic stressors: sitting for long periods of time; awkward postures of the neck, shoulders, upper extremities and back; and stresses on wrists, arms, elbows, and shoulders. Visual muscles may also be subject to static loading due to maintaining convergence and accommodation for a relatively fixed focal distance for protracted periods.

Recommended Measures for Using a Microscope

- Don't use a microscope for more than five hours per day and spread its use out over the entire workday so you don't spend long uninterrupted periods at the task.

- Keep scopes clean and use illuminators and shadow boxes properly to avoid visual and musculoskeletal strain.
- Adjust chair height so thighs are horizontal and feet are flat on the floor. Chair height should be adjustable from 15-21 inches. If necessary, use a foot rest to support the feet and prevent contact stress on the back of the legs.
- Make sure the backrest provides proper lumbar support and adjust the lumbar support so it fits the inward curvature of your lower back. Be sure to readjust when you change positions.
- Select chairs with well-padded armrests to increase stability without compressing the ulnar nerve in your arm.
- Position work surfaces high enough to allow close inspection without inclining your head beyond 17-29 degrees.
- Use a cutout worktable to place you close to the scope while providing support for your forearms.
- Periodically close your eyes or look at an object in the distance to relieve the static loading on your visual muscles.

APPENDIX V

Other Workplace Ergonomics

There are a variety of other work settings where ergonomic practices are important (e.g., manual material handling, custodial work, maintenance, gardening, etc.).

Principles for Manual Material Handling (MMH) Work Design

Force and Weight Limits for MMH tasks:

OSHA, the Occupational Safety and Health Administration, does not presently have a standard that specifies quantitative force limits for manual material handling operations, however, the Agency references the Revised NIOSH (National Institute for Occupational Safety and Health) Lifting Equation, which provides a mathematical means of evaluating MMH tasks for risk of injury. NIOSH has shown through research that a task having a Lifting Index greater than 3.0, as calculated using the Lifting Equation, can clearly be linked to an increased risk of back and other injuries.

The NIOSH Lifting Equation recommends a maximum lifting limit of 51 pounds, termed the Load Constant. The Load Constant represents the maximum load that nearly all healthy workers should be able to lift under optimal conditions. Non-optimal conditions (such as lifting frequently, poor grip quality, twisting of the torso or reaching while lifting, lifting from floor level or above shoulder level, long task duration, and the need for significant control in lifting and/or placement of the load) significantly reduce the load that can be safely lifted. Based on the parameters of the lifting task, the equation provides a Recommended Weight Limit (RWL).

Information on the Lifting Equation can be found at:
http://www.cdc.gov/niosh/docs/94-110/

While adherence to the NIOSH criteria is not mandated by OSHA, the Agency addresses employee exposure to ergonomic, and other recognized but non-regulated hazards, under the General Duty Clause of the OSH Act. The General Duty Clause requires that "each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

Eliminate the Need for Heavy MMH

The optimal solution to MMH-related problems is to eliminate the need for heavy MMH. In general, two means exist to accomplish this:

- The use of mechanical aids such as hoists, lift trucks, lift tables, cranes, elevating conveyors, gravity dumps, carts, and chutes, which can eliminate (or at least significantly decrease) physical stresses due to MMH.
- To eliminate heavy MMH, change the work area layout to make all materials available at work level and as close as possible to the work point. Accomplishing this objective can involve either a change in work level height or the level of the worker, or a change in the layout of the task area.

Decrease MMH Demands

If MMH cannot feasibly be eliminated, then attempts should be made to decrease the MMH demands of the job. There are several means by which this principle of work design can be accomplished:

- Decrease the weight of the object being handled. Assigning the handling to two or more people, by distributing the load into two or more containers, or reduce the weight of the object by reducing the capacity of the container or the container weight (e.g., using plastic drums rather than metal drums).
- Change the type of MMH activity so the demands of the job can be decreased. Lifting, lowering, pushing, pulling, carrying, and holding are all types of MMH activity. It is preferable for a job to require lowering rather than lifting, to require pulling rather than carrying, and to require pushing rather than pulling. (examples include making several trips with lighter loads or using a cart or dolly whenever possible.)
- Changes in the work area layout can decrease MMH-related demands. Some ways in which this can be accomplished include: minimizing the horizontal distance between the starting and ending points of a lift, limiting stacking heights to the shoulder height of the worker, and keeping heavy objects at the knuckle height of workers.
- Maximizing the time available to perform the job can decrease job demands. Accomplish this by reducing the frequency of the lift, and by incorporating work/rest schedules or job rotation programs into the work design.

Minimize Stressful Body Movements

Another principle of work design is to minimize stressful body movements required by the job. Specifically, bending and twisting motions imposed on the worker should be reduced.

- Reduce bending by locating objects to be handled within the arm-reach envelope of the worker. Provide all material at the work level of the worker. Avoid using deep shelves where the worker must bend and reach to obtain objects toward the rear of the shelves.

- Locate objects within the worker's arm-reach envelope to reduce twisting motions of the back. Arrange the work area to allow sufficient space for the entire body to turn and pivot with the feet. If the worker is seated, an adjustable swivel chair should be used.
- Design considerations should allow the worker to lift objects in a safe manner. Practice and encourage the safe lifting techniques described below.

Safe Lifting and Good Body Mechanics

- If an object is too heavy for you to lift safely by yourself, get help.
- Try to handle the object close to the body.
- Use devices such as handles, grips, etc., to provide better control of the object being lifted or moved.
- Balance the contents of containers.
- Provide rigid containers for increased worker control of the object.
- Avoid lifting objects from floor level, especially those that are excessively wide.
- Use good body mechanics: **bend your legs, not your back, when lifting**.
- Never twist your back when lifting; instead, turn with your feet.

Recognize the Risk for Repetitive Motion Injury

OSHA has identified five specific situations, which create significant risks for RMI, if incurred over a period of more than two to four hours:

- Performing the same motion or motion pattern for more than two hours continuously or four hours daily.
- Maintaining an unsupported fixed or awkward posture for more than one hour continuously or four hours daily.
- Using vibrating or impact tools or equipment for more than one hour continuously or two hours daily.
- Using forceful hand exertions for more than two hours daily.
- Unassisted frequent or heavy lifting

Recovery Cycles

Ergonomists agree that the most important measures to prevent repetitive stress injuries are:

- Take frequent breaks
- Move around and change postures frequently
- Do not repeat the same motions and postures
- Avoid awkward motions and postures
- Avoid application of excessive forces, especially for protracted periods

- Avoid static loading of muscles (prolonged muscle tension)
- Perform relief exercises
- Expand the tasks each person performs to minimize the constant repetition of any one particular task

The theory behind this advises: providing recovery time; time for your body to recover from exertions. Awkward postures, repetitions, or the application of force, unless extreme, are not necessarily bad. However, when sustained over time or repeated frequently so that your body does not have time to recover, the result can be a cumulative trauma injury, perhaps leading to permanent damage.

It is critical to recognize the cumulativeness of stresses and the need to balance tasks and activities. Without recovery periods, ergonomic stresses incurred during one activity become cumulative with stresses from another similar activity. For instance, hand movement stresses you incur in the lab can be cumulative with those you incur performing other activities such as using a computer keyboard or playing the piano. It is crucial to balance these activities and allow adequate recovery periods.

Anti-Fatigue Mats

Anti-fatigue mats provide relief from contact stress to the feet of the worker at standing and sit/stand workstations. Mats should be large enough for workers to stand entirely on the mat when at the workstation. Select a mat free of raised or irregular surfaces that might cause concentrated forces on the feet of the worker. Mats should be designed so they do not create tripping hazards.

APPENDIX VI

Sit/Stand Workstations

The optimal work surface height for a sit/stand workplace varies depending on the nature of the primary job tasks and the height of the worker. As a result, the ideal work station is adjustable in height. When adjustability is not possible, the recommended height for an average person performing tasks involving large-size products or drawings is 44 inches above the floor. Adequate leg clearance also reduces static loading on the legs and back of the worker. For tasks that can be done while sitting or standing, the recommended work surface height for an average person is 40 inches above the floor; a lower surface may cause stooping and static loading on the back, neck, and shoulder muscles, especially for taller workers. Seated work at a standing-height workstation requires properly designed seating with adequate foot support provided by a sturdy foot rest of proper height and sufficient size to permit periodic postural shifts of the legs while working; the foot ring on a high chair or stool is not usually adequate.

For those interested in exploring a sit/stand workstation, there are several systems that have been used at the University. Information is available from Occupational Safety on request. An ergonomic assessment is strongly recommended prior to purchasing a sit/stand to ensure appropriate equipment is selected.

Although we have not found conclusive scientific study evidence that sit/stand workstations are beneficial, there seems to be growing evidence that they may provide benefits. Because we cannot cite formal study results, Occupational Safety is making formal recommendations for sit-stand workstations only when they are prescribed by a qualified medical professional such as a physician, chiropractor, nurse practitioner, physician assistant, or physical therapist; in such cases, an ergonomic assessment should be performed by OSU to assist in selection of appropriate equipment prior to purchase. A copy of the prescription or medical professional's note should be provided to the OSU ergonomist at the time of assessment.

In cases where a sit/stand workstation has not been medically indicated, the workstation may be provided to the employee at the discretion of the employee's supervisor/department. An ergonomic assessment is strongly recommended to ensure that appropriate equipment is selected.

The sit/stand workstation must be obtained through the employee's department's normal purchasing process. If the equipment is obtained through Purchasing, the employee or his/her supervisor should provide a copy of the ergonomic assessment report to Purchasing when the sit/stand is ordered.

When a sit/stand workstation has been provided, a follow-up ergonomic assessment is recommended to verify that the equipment has been installed and adjusted correctly.

Appendix VII

Purchasing New Furniture and Accessories

- Choose furniture and chairs that will adjust sufficiently to fit all of the employees who will be using them. Plan ahead to anticipate changes in tasks and employee needs.
- Contact UR Purchasing Department for advice on the ergonomic features of products you are interested in, for price information, and vendor referrals. An ergonomic consultation with Occupational Safety is strongly recommended to ensure that appropriate equipment is selected.
- Involve all potential users in the selection process by having people try out products and provide feedback on the equipment before purchasing decisions are made.
- Have a product representative provide training on the features and proper use of the product.

Look for these features when shopping for chairs and furniture:

Chairs

- Pneumatic seat pan height adjust
- Proper seat depth (front edge to backrest)
- Backrest height adjustable
- Backrest angle and lock
- Adequate lumbar support
- Forward tilt/seat angle adjust
- Swivel with five star base
- Padded armrests with adjustable height and width
- Waterfall front edge on seat pan.
- Casters that are appropriate for the floor on which they will be used.

Table and Desk

Adjustable work surface

- Adequate dimension
- Work surface edges and corners are smooth, rounded, without sharp edges
- Adequate leg clearance and space under work surface
- Non-glare finish

Keyboard Drawer/Articulating Arm with Tray

- Height and angle easily adjustable

- Designed to accommodate the mouse or other pointing device next to keyboard, on same level.
- Built-in soft wrist rest (not the metal lip); or enough room for an add-on wrist rest
- Make sure there will be adequate legroom under the keyboard drawer/platform once it is installed.