Human Factors Engineering

Presented By:
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Human Factors Engineering
Also known as...

Ergonomics!
Objectives

• Define “ergonomics” and “WMSD”.
• Discuss elements of a successful ergonomics program and the importance of assessing ergonomic conditions in the workplace.
• Identify:
  – Ergonomic disorders and risk factors.
  – Basic ergonomic solutions.
  – Models for assessing ergonomic risk factors.
  – Calculation of ergonomic incidence rates.
  – MIOSHA ergonomic initiatives.

Definition – Ergonomics

• “Ergon” – Greek word for “work”.
• “Nomics” – word for “study”.
• Ergonomics – the study of work.
• Work smarter; not harder!
Ergonomic Disciplines

Ergonomics combines the following disciplines to evaluate how the workstation fits the employee:

– Process and/or product engineering
– Biomechanics
– Epidemiology
– Physiology
– Anthropometry

Ergonomics History

• Ergonomics is not an issue of the 20th or 21st century
• From Bernardino Ramazinni:
  – Early occupational health physician
  – Studied diseases workers obtained due to their crafts
  – *Treatise on the Diseases of Workers*, 1713
  – Two causes of work-related disease:
    • *Harmful character of the materials they handle.*
    • *Due to violent, irregular motions and unnatural postures of the body...the natural structure of the vital machine is so impaired that serious diseases gradually develop there from.*
Why is Ergonomics Important?

To prevent the development of Work Related Musculoskeletal Disorders (WMSDs):

– Disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, and spinal discs.
– Result of chronic overuse of body parts.
– Approximately 400,000 cases each year.
– Costs per case estimated at between $6000 and $25,000.
– Resulting in loss of productivity, personal pain, suffering, and worker dissatisfaction.

Why is Ergonomics Important?

Per the National Institute for Occupational Safety and Health (NIOSH):

– Musculoskeletal disorders account for nearly 70 million physician office visits in the United States annually, and an estimated 130 million total health care encounters including outpatient, hospital, and emergency room visits.
– The Institute of Medicine estimates of the economic burden of WMSDs (as measured by compensation costs, lost wages, and lost productivity) are between $45 and $54 billion annually.
– The Bureau of Labor Statistics reported 26,794 Carpal tunnel syndrome cases involving days away from work in 2014.
– In 2001, the Bureau of Labor Statistics reported 372,683 back injury cases involving days away from work.
Incidence and Cost of Ergonomic Disorders

Per the analysis of Liberty Mutual Insurance, of the leading causes and direct costs of workplace injuries in 2012, ergonomic disorders garnered three of the top ten places.

1. Overexertion; $15.1B; 25.3%
5. Other exertions or bodily reactions; $4.27B; 7.2%
9. Repetitive motions involving micro-tasks; $1.84B; 3.1%

Ergonomics Injury Costs

• **OSHA’s Safety Pays Program** provides a chart of average injury costs. Take a look at the following *direct costs* of selected ergonomic injuries:
  – Carpal Tunnel Syndrome: $28,647
  – Sprain: $28,338
  – Strain: $32,319
  – Inflammation: $32,080

• The program also aids with calculating the *indirect costs*. 
OSHA's Safety Pays Program

- OSHA's “Safety Pays” program helps employers assess the impact of occupational injuries and illnesses on their profitability.
- The program uses a company's profit margin, the average costs of an injury or illness, and an indirect cost multiplier to project the amount of sales a company would need to cover those costs.
- The program is intended as a tool to raise awareness of how occupational injuries and illnesses can impact a company's profitability, not to provide a detailed analysis of a particular company's occupational injury and illness costs.
- The program:
  - Allows users to pick an injury type from a drop-down list or to enter their workers' compensation costs.
  - Prompts users for information to do the analysis, including their profit margin and number of injuries.
  - Generates a report of the costs and the sales needed to cover those costs.

For every $1 in Direct Costs, there are approximately $4-$10 in Indirect Costs
Understanding the Cost of WMSDs

• Management needs to understand costs of:
  – Medical bills
  – Lost wages
  – Rehabilitation
  – Lost management and administrative time
  – Retraining of workers and training of new workers

• Cost analysis:
  – Direct true costs (actual values but difficult to obtain)
  – Indirect true cost (estimate cost by multiplying direct workers’ compensation cost by 4)

Ergonomic Analysis

Trend Analysis of Events and Costs

• Identifies program success or need for improvement.
• Aids in making the case to management.
Developing an Ergonomics Program

Effective Ergonomics Program

Ideal Outcomes

• Gains management support and commitment.
• Provides training for employees and other appropriate parties.
• Identifies risk factors present in the workplace.
• Develops and implements appropriate and feasible:
  – Engineering controls
  – Administrative and work practices controls
  – Medical management of WMSDs
Elements of an Effective Ergonomics Program

• Management Leadership
• Employee Participation
• Workplace Analysis
• Records Analysis
• Hazard Prevention and Control
• Medical Management
• Training

Workplace Analysis Tools

• Get out of the office and into the workplace:
  – Perform workplace walkthroughs
  – Observe employee tasks
  – Talk with employees:
    • Aches and pains
    • Suggestions for improvement
• Periodic screening surveys
• Records reviews
General Anatomy of the Body
The Wrist

Work-Related Musculoskeletal Disorders (WMSDs)

- Disorders of the:
  - Nerves
  - Tendons
  - Muscles and/or
  - Blood vessels

- A major cause of impairment, disability, and recordable and compensable injury in the workplace.
- Frequently reported in the upper limbs and neck.
**WMSD Facts**

- Result from mechanical (workplace or personal activity stressors) and physiological (genetics) process.
- Related to:
  - Multiple work and personal causes.
  - Intensity and duration of activity.
- Require periods of weeks, months, or years:
  - To develop.
  - For recovery.
- Often goes unreported for lengthy time periods.
- If untreated, results in pain and impaired physical performance.

**WMSD Health Impacts**

![Image showing localized fatigue and chronic pain with identified disorder (e.g., CTS) and localized fatigue over time.](image-url)
Symptoms of WMSDs

• Common symptoms:
  – Stiffness
  – Cramping
  – Tingling
  – Burning
  – Numbness
  – Pain

• Other, less common symptoms:
  – Decreased range of motion or grip strength
  – Loss of muscle function
  – Deformity

Common Types of WMSDs

• Tendon Disorders
  – Tendinitis (also tendonitis)
  – Bursitis
  – Ganglion cyst
  – Tenosynovitis
  – Trigger finger
  – DeQuervain’s tenosynovitis
  – Epicondylitis (tennis or golfer’s elbow)

• Nerve Disorders
  – Carpal tunnel syndrome (CTS)
  – Cubital tunnel syndrome
  – Guyon’s canal syndrome

• Neurovascular Disorders
  – Thoracic outlet syndrome

• Strains and Sprains
• Back Disorders
Tendinitis

- Inflammation/swelling of a tendon
- Generally referred to by the body part involved – common in the wrist, elbow, and shoulder but can occur in other areas
- Causes include repetitive and forceful exertions

Bursitis

- Inflammation of one or more small sacs (bursae) of synovial fluid.
- Sacs cushion the bones, tendons, and muscles near joints.
- Common associated with the shoulder, elbow, and hip, but can occur at other joints.
- Movement of tendons and muscles over inflamed sacs may aggravate the inflammation.
Ganglion Cyst

- Noncancerous lumps that commonly develop inside the tendon sheath.
- Typically round or oval, 0.25-to-1 inch in diameter, and filled with a jelly-like fluid.
- Commonly impacts joints of the wrist or hand; also the ankles, feet, or other joints.
- Painful if it impinges on a nearby nerve and/or can impair joint function.
- Causes include repetitive and forceful hand exertions.
- Often clears without treatment; may require draining or removal.

Tenosynovitis

- Inflammation of fluid-filled sheath surrounding a tendon.
- Causes include highly repetitive motions.
- Stenosing tenosynovitis: the finger sticks in a flexed position (“trigger finger”).
**Trigger Finger (Stenosing Tenosynovitis)**
( Texters and gamers beware!)

- Finger becomes stuck in the bent position; it may straighten (extend) with a “snapping” sound, like a trigger.
- Causes include repetitive gripping actions.

**DeQuervain’s Tenosynovitis**

- A painful condition impacting the thumb side of the wrist.
- Creates pain when turning the wrist, grasping things, or making a fist.
- The exact cause is unknown, though stressors include:
  - Repetitive/chronic hand or wrist movement,
  - Excessive gripping, grasping, clenching, pinching, and wringing things, and
  - Scar tissue and rheumatoid (inflammatory) arthritis.
Epicondylitis

- Inflammation of the rounded projection located at the end of a bone which serves as a place of attachment for ligaments and tendons.
- Two types at the elbow:
  - Golfer’s elbow (medial epicondylitis) and
  - Tennis elbow (lateral epicondylitis).
- Causes include:
  - Use of the arm for impact or awkward throwing motions.
  - Repeated or forceful forearm rotation while bending the wrist or clenching of the fingers.

Carpal Tunnel Syndrome (CTS)

- Entrapment of the median nerve in the carpal tunnel
- Symptoms:
  - Burning and/or numbness in wrist
  - Tingling in digits 1, 2, 3, and half of 4 (thumb through half of ring finger)
- Risk factors:
  - Forceful hand exertions
  - Repetitive wrist and finger movements
  - Awkward wrist postures
  - Hand/wrist vibration exposure
Cubital Tunnel Syndrome

• Results from compression of the ulnar nerve at the elbow (ulnar nerve entrapment).
• Symptoms include tingling, numbness, and pain in ring and pinkie fingers.
• Causes include resting elbows on hard surfaces for prolonged periods.

Guyon’s Canal Syndrome

• Results from compression of the ulnar nerve as it passes through the Guyon canal in the wrist.
• Symptoms:
  – Feeling of pins and needles in the pinkie (5th finger) and ring finger (4th finger).
  – Leads to decreased sensation, weakness, and clumsiness in the hand.
Thoracic Outlet Syndrome

- Compression of the neurovascular bundle (nerves and blood vessels) as they pass through muscles of the neck and into the shoulders.
- Causes include work forceful and/or repetitive work above the shoulder.

Strains and Sprains

- Strain:
  - An injury to a muscle or tendon in which the muscle fibers tear as a result of overstretching.
  - Also known as pulled muscles; common in the lower back and thigh muscles.
  - May result in localized pain, stiffness, discoloration, and bruising around the strained muscle.
- Sprain:
  - An injury to a ligament caused by overstretching – may result in tears.
  - Ligaments connect bones to bones across a joint.
  - Common in ankles and sometimes the knee.
- Provide specifics when recording on I/I log.
Back Disorders

• Back anatomy:
  – Spine
  – Vertebrae
  – Spinal discs
  – Nerves
  – Connective tissues

• Types include:
  – Single event exertion injuries
  – Degenerative disc disease
  – Herniated/ruptured/bulging discs
  – Sciatica

Other Ergonomic Illnesses

• Neuritis
• Raynaud’s phenomenon
• Hand-arm vibration syndrome
• Rotator cuff syndrome
• Tension neck syndrome
• Carpet layer’s knee
• Tarsal tunnel syndrome
• Plantar fasciitis
Over time, exposure to risk factors may lead to a WMSD.

**OCCUPATIONAL Risk Factors**
- PRIMARY
  - Force
  - Repetition
  - Awkward posture
- OTHER
  - Mechanical compression
  - Static postures
  - Duration
  - Vibration
  - Temperature

**INDIVIDUAL Risk Factors**
- Age and gender
- Anthropometry
- Poor fitness
- Poor health habits

**Force**
- Lifting
- Pulling
- Pushing
- Small muscles applying great force (e.g., pinch grip)
- Fatigue, wear and tear on muscles, ligaments, spinal discs
Defining Force
Example From WISHA Caution/Hazard Zone Checklist

Lifting objects weighing more than:

- 75 pounds once per day or more (hazard).
- 55 pounds more than 10 (hazard) or 20 (caution) times per day.
- 10 pounds (caution) or 20 pounds (hazard) above the shoulders, below the knees or at arms length more than 25 times per day.
- 10 pounds, if done more than twice per minute, more than 2 hours total per day (caution) or 4 hours total per day (hazard).

Force
Example 1 – Unknown Manufacturing Operation
**Force**

Example 2 – Beverage Industry

- 1 keg = 15 gallons ≈ **175 lbs**
- 1 case of canned beverage ≈ 18 lbs
- 1 cased of bottled beverages ≈ 25 lbs
- Case driver (delivers cases primarily):
  - Delivers 700-1,000 cases per day.
  - Also delivers 10-15 kegs per day.
- Draft driver (delivers kegs primarily) delivers 75-125 kegs per day.

**Awkward Postures**

- Bending
- Twisting
- Squatting
- Kneeling
- Hands over head
- Frequency, duration, use of force while in the awkward position
Awkward Posture
Wrist Deviations

As the wrist leaves the straight or “neutral” posture, grip strength is decreased. The figure below shows that grip strength can be decreased by up to 45% (Eastman Kodak, 1986).

“Working in Neutral”

Limiting awkward postures of the body and attempting to work primarily in a neutral position that favors the body’s nature mechanics.
Defining Awkward Posture
Example From WISHA Caution/Hazard Zone Checklist

- Work with back bent forward more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day
- Working with back bent forward more than 45° (without support or the ability to vary posture) more than 1 hour total per day (caution) or more than 2 hours total per day (hazard).

Awkward Postures
Example 1 – Concrete Work
Awkward Postures
Example 2 – Hospitals and Residential Care Facilities

Awkward Postures
Example 3 – Beverage Industry
Awkward Postures
Example 4 – Picking Strawberries

Repetitive Motion

• Occur every few seconds for an 8-hour shift.
• Lack of recovery time.
• Increased ergonomic stress in conjunction with force and posture.
Defining Repetitive Motion
Example From WISHA Caution/Hazard Zone Checklist

• Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few seconds, for > 2 hours total per day (caution) or more than 6 hours total per day (hazard).

• Repetition “caution” plus high, forceful exertions with the hand(s) and wrist deviation more than 2 hours total per day (hazard).

Repetitive Motions
Example 1 – Unknown Manufacturing Operation
Repetitive Motions
Example 2 – Foundry Coring Room

Mechanical Compression

• Occurs due to contact stresses.
• Repeated or continuous contact with sharp objects:
  – Use of body part as a hammer.
  – Leaning or pressing up against an object.
• Causes impairment of nerve function and blood circulation.
• Example: using the knee as a hammer more than 10 times per hour (caution) or more than 1 time per minute (hazard) for more than 2 hours per day.
Static Postures

- Muscles perform both dynamic and static work.
- Full force at >10 seconds leads to fatigue.

Duration

- Amount of time a person is continually exposed to one or more risk factor(s).
- In general, the longer the duration of continuous work, the longer the rest or recovery period needed.
Vibration

- Whole body or localized contact with vibrating tools, machines, or vehicles.
- Impairs/disrupts nerve function and blood flow.

Defining Vibration Stress

Example From WISHA Caution/Hazard Zone Checklist

- Using grinders, sanders, jigsaws or other hand tools that typically have moderate vibration levels for more than 2 hours per day (caution) or more than 4 hours per day (hazard).
- Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammers, scalers, riveting or chipping hammers) or other tools that typically have high vibration levels for more than 30 minutes per day (caution) or more than 1 hour per day (hazard).
Other Ergonomic Considerations

• Temperature:
  – Decreased blood flow to muscles
  – Commonly a result of cold air exhaust from pneumatic tools discharging on the body
• Unfamiliar or unaccustomed work
• Individual risk factors...

Individual Risk Factors

• Age
• Gender
• Smoking
• Physical activity
• Strength
• Anthropometry
Task Analysis Video

Show CLMI, *Ergonomic Task Analysis, Module 1, Survey and Analyze*, video.

**Product Description:** An efficient and capable ergonomics team can be highly effective at enhancing the well-being of your employees, while lowering your company’s cumulative trauma injury costs. This video will help to teach your team the basic concepts, knowledge, and skills necessary to perform an ergonomic task analysis in a manufacturing setting.

Risk Factor Identification

**Differential Housing Line**
Class Exercise 1
Risk Factor Identification and Assessment Tool

• Small group activity:
  – Break into 5-6 groups
  – View video
  – Break job into tasks
  – Discuss and identify risk factors for each task on the “Task Hazard Analysis” form in appendix (about 10 minutes)

• Identify risk factors on “Job Hazard Analysis” form in appendix
• Group discussion on findings (about 10-20 minutes)
• May show a second video clip (trim flashing) if time permits

Class Exercise 1: Risk Factor Identification
Door Drill Operation
Ergonomic Solutions

Preferential order of implementation:

1. Engineering controls
2. Administrative controls
3. Personal protective equipment (PPE)

Engineering Controls

• When feasible (economically and technologically)
• Best implemented during process design or redesign – think about:
  – Configuration and adjustability of task/equipment
  – Easy access for controls (avoid awkward postures)
  – Reduce lifting and reaching
  – Select tools to fit the task
Engineering Control Examples

• Chairs with good/adjustable back support
• Lean stands for employees standing for long periods
• Tools:
  – Ergonomically designed if appropriate
  – Mechanical lift assists
  – Turn tables
  – Torque reducers
  – Material conveyors
  – Height-adjustable workstations
• Vibration damping devices
• Workstation redesign
• Process flow redesign

Administrative Controls

• Impact how tasks are assigned, scheduled, and performed
• Attempts to reduce magnitude and frequency of exposure to risk factors
• Examples:
  – Job rotation
  – Task enlargement
  – Provision of rest breaks
  – Assignment of additional employees to perform task
  – No-lift or two-person lift policies
  – Workplace warm-up programs
Administrative Controls – continued

• Also teach/supervise appropriate work practices, such as:
  • “Work in neutral” – limiting awkward postures of the body and attempting to work primarily in a neutral position that favors the body’s natural mechanics.
    – Support lower back when sitting
    – Maintain firm stomach muscles while standing
    – Avoid:
      • Reaching above the shoulders or below the waist
      • Repetitive motions
      • Lifting heavy loads

Effective Job Rotation/Enlargement

Must modify:
  – Muscles or body parts used;
  – Working postures;
  – Amount of repetition;
  – Pace of work;
  – Amount of physical exertion (force) required; and
  – Visual and mental demands (stress); and Environmental conditions.
Personal Protective Equipment (PPE)

- Not an effective control measure for ALL types of ergonomic disorders.
- Proper glove selection and usage when necessary for the task.
- Do not use splints or back belts:
  - As PPE as an ergonomic “control” device.
  - Without proper medical evaluation and recommendation – may cause more damage if improperly implemented!

Engineering Controls – Example 1
Tilted Basket
Engineering Controls – Example 2
Rotating, Height Adjustable Scissor Lift

Engineering Controls – Example 3
Vacuum Lift Assist (left) and Sit/Stand Station (right)
Engineering Controls – Example 4
Articulating Arms/Torque Reduction/In-line Tools

Engineering Controls – Example 5
Pistol Versus Inline Tool Grip

Old Method
New Method
**Work Practice Control Example**
Change How Tool is Gripped

Old Method  
New Method

**Prioritizing Control Efforts**

- **Highest Priority**
- **Lowest Priority**

- Incidence and Cost of Injuries/Illnesses
- Ergonomic Risk Factors
Evaluating Installed Controls

- Has the installed control:
  - Reduced or eliminated risk factors, symptoms, and/or injuries?
  - Been accepted by employees?
  - Created any new risk factors, hazards, or other concerns?
  - Caused decreases in productivity, efficiency, and/or quality?
  - Been supported with training to ensure effectiveness of the control?
- If “yes,” re-evaluate and implement new control measure.

Class Discussion Point

Describe any ergonomic controls that have been implemented in your workplace.
Ergonomic Task Analysis Tools

• WISHA Caution/Hazard Zone Checklist (Modified)
• Threshold Limit Value (TLV) and Action Limit (AL) for Hand Activity
• Manual Material Handling (MMH) Guidelines (Snook Tables)
• Muscle Fatigue Assessment (MFA)
• Revised NIOSH Lifting Equation (1991)
• Occupational Repetitive Action (OCRA) Index
• Ovako Working Posture Analysis System (OWAS)
• Rapid Entire Body Assessment (REBA)
• Rapid Upper Limb Assessment (RULA)
• Shoulder Moment Model
• Moore-Garg Strain Index
• Utah Back Compressive Force Model

NOTE: Only brief overview and not a detailed application of these tools will be presented.

WISHA Caution/Hazard Zone Checklist (Modified)

• Washington Industrial Safety and Health Act (WISHA)
• From Washington Department of Labor and Industries; updated in 2010.
• Body part(s): low back, hand/wrist, neck, shoulder, knee.
• A checklist
• Evaluate workplace for specified conditions and then, if conditions are met, identify them as posing a Caution or a Hazard.
• Conditions primarily based on duration of task. Repetition and force also considered as well.
WISHA Caution/Hazard Zone Checklist Example

**Low Back Posture**

<table>
<thead>
<tr>
<th>Posture</th>
<th>Overall: None</th>
<th>Caution</th>
<th>Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with the back bent forward more than 30° (without support or the ability to vary posture)</td>
<td>More than 2 hours total per day.</td>
<td>Caution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 4 hours total per day</td>
<td>Hazard</td>
<td></td>
</tr>
<tr>
<td>Working with the back bent forward more than 45° (without support or the ability to vary posture)</td>
<td>More than 1 hour total per day.</td>
<td>Caution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 2 hours total per day</td>
<td>Hazard</td>
<td></td>
</tr>
</tbody>
</table>

**Weight/Force**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Overall: None</th>
<th>Caution</th>
<th>Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting object weighing more than 75 pounds</td>
<td>One or more times per day</td>
<td>Hazard</td>
<td></td>
</tr>
</tbody>
</table>

Threshold Limit Value (TLV) and Action Limit (AL) for Hand Activity

- Published by the American Conference of Governmental Industrial Hygienists (ACGIH®).
- Body part(s): hands/wrists and arms/elbows.
- Determine the following ratio:
  \[
  \frac{NPF}{(10 - HAL)}
  \]
  - NPF = normalized peak hand force
  - HAL = hand activity level rating
- Ratio is then compared to the action level (AL) and the threshold limit value (TLV).
  - AL = 0.56 (establishes intermediate risk region)
  - TLV = 0.78 (further analysis/job redesign if exceeded)
# Hand Activity Level TLV and AL

## Normalized Peak Hand Force (NPF) Table

<table>
<thead>
<tr>
<th>Subjective Scale (Borg CR 10)</th>
<th>Verbal Anchor</th>
<th>Moore-Geg Observer Scale (Alternative Method)</th>
<th>NPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Nothing at all</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0.5</td>
<td>Extremely Weak (just noticeable)</td>
<td>0.5</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>Very Weak</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>Weak (light)</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>3</td>
<td>Moderate</td>
<td>3</td>
</tr>
<tr>
<td>40</td>
<td>4</td>
<td>Obvious Effort, but unchanged facial expression</td>
<td>4</td>
</tr>
<tr>
<td>50</td>
<td>5</td>
<td>Strong (heavy)</td>
<td>5</td>
</tr>
<tr>
<td>60</td>
<td>6</td>
<td>Substantial effort with changed facial expression</td>
<td>6</td>
</tr>
<tr>
<td>70</td>
<td>7</td>
<td>Very Strong</td>
<td>7</td>
</tr>
<tr>
<td>80</td>
<td>8</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>90</td>
<td>9</td>
<td>Uses Shoulder or Trunk for force</td>
<td>9</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>Extremely Strong (almost maximum)</td>
<td>10</td>
</tr>
</tbody>
</table>

## Hand Activity Level (HAL) Rating

- **0**: Hand idle most of the time; no regular exertions
- **2**: Consistent, conspicuous, long pauses; or very slow motions
- **4**: Slow, steady motion/exertions; frequent brief pauses
- **6**: Steady motion/easier exertion; infrequent pauses
- **8**: Rapid, steady motion/exertions; no regular pauses
- **10**: Rapid, steady motion/difficulty keeping up or continuous exertions
Manual Material Handling Guidelines

- Body part(s): back.
- Assesses acceptable weight or force limit for manual material handling for 75% and 90% males and females:
  - Lift/lower load
  - Push/pull load
  - Carry load
- Also known as the Snook tables.
- Suggests back injuries will be reduced by 2/3 if tasks are designed so they can be performed by 75% of the population.

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MMH Guidelines
Activities and Variables

<table>
<thead>
<tr>
<th>Activity</th>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift/lower</td>
<td>Gender</td>
<td>Male or Female</td>
</tr>
<tr>
<td>Lift/lower</td>
<td>Percent Capable</td>
<td>Percentage of the industrial population capable of performing the lift/lower safely</td>
</tr>
<tr>
<td>Lift/lower</td>
<td>Load Distance</td>
<td>The horizontal distance the box is held away from front of the body</td>
</tr>
<tr>
<td>Lift/lower</td>
<td>Lift/Lower Height</td>
<td>Range of motion in reference to the body before the lift/lower is taking place</td>
</tr>
<tr>
<td>Lift/lower</td>
<td>Lift/Lower Distance</td>
<td>Vertical distance the object is moved during lift/lower</td>
</tr>
<tr>
<td>Lift/lower</td>
<td>Frequency</td>
<td>The rate at which the lift/lower is performed</td>
</tr>
<tr>
<td>Push/Pull</td>
<td>Gender</td>
<td>Male or Female</td>
</tr>
<tr>
<td>Push/Pull</td>
<td>Percent Capable</td>
<td>Percentage of the industrial population capable of performing the push/pull safely</td>
</tr>
<tr>
<td>Push/Pull</td>
<td>Initial or Sustained Force</td>
<td>Initial Force - the force required to get an object in motion. Sustained Force - the force required to keep an object in motion</td>
</tr>
<tr>
<td>Push/Pull</td>
<td>Height</td>
<td>Height from the floor to the hands where the push/pull is taking place</td>
</tr>
<tr>
<td>Push/Pull</td>
<td>Distance</td>
<td>The distance the object is moved across the floor</td>
</tr>
<tr>
<td>Push/Pull</td>
<td>Frequency</td>
<td>The rate at which the push/pull is performed</td>
</tr>
<tr>
<td>Carry</td>
<td>Gender</td>
<td>Male or Female</td>
</tr>
<tr>
<td>Carry</td>
<td>Percent Capable</td>
<td>Percentage of the industrial population capable of performing the carry safely</td>
</tr>
<tr>
<td>Carry</td>
<td>Height</td>
<td>Vertical distance from the floor to the hands</td>
</tr>
<tr>
<td>Carry</td>
<td>Distance</td>
<td>The horizontal distance the object is carried</td>
</tr>
<tr>
<td>Carry</td>
<td>Frequency</td>
<td>The rate at which the carry is performed</td>
</tr>
</tbody>
</table>
MMH Guidelines
Maximum Acceptable Forces/Weights Example

Muscle Fatigue Assessment (MFA)

- Body part(s): neck, back, shoulders, arms/elbows, hands/wrists, and legs.
- Assesses risk of exposures to static or repetitive issues.
- Assigns “priority for change” score for each body region based on the risk of muscle fatigue in the order of:
  - Effort level,
  - Continuous effort duration, and
  - Frequency.
### Muscle Fatigue Assessment (MFA)

#### Task Analysis Table

<table>
<thead>
<tr>
<th>Region</th>
<th>Effort Level</th>
<th>Scores</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light – 1</td>
<td>Moderate – 2</td>
<td>Heavy – 3</td>
</tr>
<tr>
<td>Neck</td>
<td>Head turned partly to side, back or slightly forward</td>
<td>Head turned to side, head fully forward; head forward about 20°</td>
<td>Same as Moderate but with force or weight; head stretched forward</td>
</tr>
<tr>
<td>Shoulders</td>
<td>Arms slightly away from side; arms extended with some support</td>
<td>Arms away from body; no support; working overhead</td>
<td>Exerting forces or holding weight with arms away from body or overhead</td>
</tr>
<tr>
<td>Back</td>
<td>Leaning to side or bending, working back</td>
<td>Bending forward; no load; lifting moderate; heavy loads near body; working overhead</td>
<td>Lifting or exerting force while bending; high force or load while bending</td>
</tr>
<tr>
<td>Arms</td>
<td>Arms away from body, no load; raising arms while seated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Overall Priority Ranking Matrix

A category of “4” for Effort Level, Continuous Effort Duration, or Frequency is automatically ranked “Very High”.

<table>
<thead>
<tr>
<th>Effort Level</th>
<th>Low (L)</th>
<th>Moderate (M)</th>
<th>High (H)</th>
<th>Very High (VH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>111</td>
<td>123</td>
<td>223</td>
<td>323</td>
</tr>
<tr>
<td></td>
<td>112</td>
<td>132</td>
<td>313</td>
<td>331</td>
</tr>
<tr>
<td></td>
<td>113</td>
<td>213</td>
<td>321</td>
<td>332</td>
</tr>
<tr>
<td></td>
<td>211</td>
<td>222</td>
<td>322</td>
<td>4xx, x4x, xx4*</td>
</tr>
<tr>
<td></td>
<td>121</td>
<td>231</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>212</td>
<td>232</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>311</td>
<td>312</td>
<td></td>
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<td></td>
<td>122</td>
<td>321</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>131</td>
<td>322</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>221</td>
<td>323</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continuous Effort Duration</th>
<th>Low (L)</th>
<th>Moderate (M)</th>
<th>High (H)</th>
<th>Very High (VH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 s</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 (Enter VH for Priority)</td>
</tr>
<tr>
<td>≥ 6 s</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 (Enter VH for Priority)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effort Frequency</th>
<th>Low (L)</th>
<th>Moderate (M)</th>
<th>High (H)</th>
<th>Very High (VH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 / min</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 (Enter VH for Priority)</td>
</tr>
<tr>
<td>≥ 1 / min</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 (Enter VH for Priority)</td>
</tr>
</tbody>
</table>
Revised NIOSH Lifting Equation

- National Institute for Occupational Safety and Health
- Body part(s): back.
- Developed using epidemiological, physiological, biomechanical, and psychophysical criteria.
- Assesses two-handed lifting-related back pain with regard to the L5-S1 vertebral disc.

NIOSH Lifting Equation

Recommended Weight Limit (RWL)

Determined for both the origin and destination of the movement. Multipliers chosen from tables of data.

\[ \text{RWL} = \text{LC} \times \text{HM} \times \text{VM} \times \text{DM} \times \text{AM} \times \text{FM} \times \text{CM} \]

- LC = load constant (51 pounds)
- HM = horizontal multiplier factor (location of the object relative to the body)
- VM = vertical multiplier factor (location of the object relative to the floor)
- DM = distance multiplier factor (distance the object is moved vertically)
- AM = asymmetry multiplier factor (angle or twisting requirement)
- FM = frequency and duration of lifting activity multiplier factor
- CM = coupling multiplier factor (quality of the worker’s grip on the object)
NIOSH Lifting Equation

Lifting Index (LI)

\[ LI = \frac{Actual \ Load}{RWL} \]

- \( LI \leq 1 \): This lift may be acceptable.
- \( 1 < LI < 1 \): This lift may increase the risk of low back or lifting injury. Controls should be considered.
- \( LI > 3 \): This lift may exceed the capabilities of safely performing the lift for nearly all workers. Redesign of the lifting task is recommended.

Occupational Repetitive Action (OCRA) Index

- Developed by Occhipinti (1998).
- Body part(s): shoulders, arms/elbows, hands/wrists.
- Quantifies the relationship between a number of elements (e.g., duration of task, recovery time, grip type and finger movement, etc.) associated with the upper extremities during a shift to determine an OCRA Index which identifies the ergonomic risk level and recommended action.
OCRA Index

\[ \text{OCRA Index} = \frac{\text{ATA}}{\text{RTA}} \]

<table>
<thead>
<tr>
<th>OCRA Index Value</th>
<th>0</th>
<th>1.1</th>
<th>2.3</th>
<th>3.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Green</td>
<td>Green/Yellow</td>
<td>Yellow/Red</td>
<td>Red</td>
</tr>
<tr>
<td>Risk Level</td>
<td>No Risk</td>
<td>Very Low Risk</td>
<td>Low Risk</td>
<td>Risk Present</td>
</tr>
<tr>
<td>Recommended Action</td>
<td>No Action</td>
<td>No Action</td>
<td>Set up health surveillance. Set up improvement actions for exposure conditions.</td>
<td>Redesign tasks and workplaces according to priorities. Administer health surveillance, training, and information programs to exposed individuals.</td>
</tr>
</tbody>
</table>

Ovako Working Posture Analysis System (OWAS)

- Body part(s): back, shoulders, and legs (secondarily: arms/elbows and hands/wrists).
- Evaluates back, arm, and leg posture, weight of the load handled, percent of time the task in the task to develop determine an action category.
- The action category indicates the urgency and priority for corrective measures based on the percent of time spent in certain postural combinations with a load or force.
**Rapid Entire Body Assessment (REBA)**

- Developed by Hignett and McAtamney (2000) for healthcare and other service industries.
- Body part(s): neck, back, shoulders, and legs, arms/elbows, hands/wrists, and legs.
- Evaluates postures, force/load, coupling, and type of activity to determine a REBA Score (1-to-15). Then determines an Action Level for the task evaluated based on postures, forces/loads, coupling and activity level.
- Common usage in healthcare and service industries.
REBA Employee Assessment Worksheet

Used to determine risk level and recommended action (none necessary, may be necessary, necessary, necessary soon, and necessary now).

Rapid Upper Limb Assessment (RULA)

• Developed by McAtamney and Corlett (1993).
• Body part(s): shoulders, arms/elbows, and hands/wrists (secondarily: neck, back, and legs).
• Quickly screens individuals for risk exposure to likely work-related upper extremity disorders.
• Determines an Action Level for the task based on postures, force/loads, and muscle use.
• Teaches importance of posture and role in muscle loading.
RULA Worksheet

Actions to take are based on the RULA Score:

– Posture acceptable
– Further investigation needed; changes may be required
– Investigation and changes required soon
– Investigation and changes required immediately

Shoulder Moment Model

• Developed by Bloswick and Villnave (2000).
• Body part(s): shoulders.
• Semiquantitative method to calculate the shoulder moment (i.e., torque where force is concerned) and compare it against the shoulder moment of the 25th percentile (meaning 75% capable) female.
Shoulder Moment Model Calculation

\[ M_T = (M_L + M_A) = (d_L + L) + (0.0115 \times BW \times d_L) \]

- \( M_T \) = total moment (inch-pounds force, in-lbf)
- \( M_L \) = load moment (in-lbf)
- \( M_A \) = arm moment (in-lbf)
- \( d_L \) = distance from shoulders to load (inches)
- \( L \) = load weight (lbs)
- \( 0.0115 \) = arm weight fraction of total body weight
- \( BW \) = body weight (lbs)

- GOAL: \( M_T < 270 \text{ in-lbf} \) (shoulder moment of 25th percentile female)

Moore-Garg Strain Index

- Body part(s): hands/wrists and lower arm/elbow.
- Assesses intensity and duration of exertion, efforts per minute, hand/wrist posture, speed of work, and daily task duration for the risk of work-related musculoskeletal disorders of the distal upper extremity based on physiological, biomechanical, and epidemiological knowledge to determine strain index.
- The strain index is used to identify the ergonomic risk of performing the evaluated job.
Utah Back Compressive Force Model

• Developed by Merryweather, Loeryscher, and Bloswick (revised in 2008).
• Body part(s): back (L5-S1).
• A semiquantitative model using body weight and height, load weight, horizontal distance, and torso flexion angle estimate the compressive force in the low back.
• The revision developed gender-specific equations.

Utah Back Compressive Force Calculations

\[
F_{c(female)} = 0.0175(BW)(HT)(\sin \theta) + 0.152(L)(HB) + 0.8\text{(BW/2 + L)} + 20
\]

\[
F_{c(male)} = 0.0167(BW)(HT)(\sin \theta) + 0.145(L)(HB) + 0.8\text{(BW/2 + L)} + 23
\]

• \(BW\) = body weight (kg)
• \(HT\) = height (cm)
• \(L\) = load weight (kg)
• \(\theta\) = torso flexion angle (degrees)

• \(F_c > 350 \text{ kg (770 lbs)}\) puts some portion of the workforce at risk for injury
• \(F_c > 650 \text{ kg (1,430 lbs)}\) puts most members of the workforce at risk for injury
Class Discussion Point

Has your workplace implemented an ergonomics program? If so, describe what has been your experience with its implementation?

Prioritizing Jobs for Improvement

• Frequency and severity of:
  – Identified risk factors that may lead to injuries.
  – Complaints, symptoms, and/or injuries.
• Available technical and financial resources.
• Employee comments/suggestions.
• Difficulty in implementing improvements.
• Timeframe for making improvements.
Calculation of Ergonomic Incidence Rates

Calculating Incidence Rates

- Types of incidence rates:
  - Total case incidence rate (TCIR): addresses all cases
  - Days away, restricted, and transfer time (DART) rate: addresses serious cases only
  - Ergonomic case incidence rate
- Sites for TCIR and DART rates for comparison against company rates:
  - MIOSHA (“incidence rate by industry” reports):  
    http://www.michigan.gov/lara/0,4601,7-154-61256_11407_30929-39936-00.html
  - OSHA (“summary tables” then “incidence rates – detailed industry level” reports):  
    http://www.bls.gov/iif/oshsum.htm
Ergonomic Incidence Rates

Information to obtain:

– Number of ergonomic cases:
  • Similarly exposed workgroups (SEGs)
  • Avoid strain/sprain cases not caused by ergonomic stressors (e.g., strain caused by a slip or trip)
– Total number of employee-hours worked by SEG employees:
  • Usually not the hours worked by all employees
  • May estimate by determining the number of employees in the SEG and multiplying by 2,000 hours worked per year
– Establish a site action level and trend rates yearly

Calculating an Ergonomic Incidence Rate

Ergo IR (actual) = \frac{(# \text{ of Ergo Cases in SEG}) \times 200,000}{(# \text{ of Employees-hours Worked by SEG})}

Ergo IR (estimated) = \frac{(# \text{ of Ergo Cases in SEG}) \times 100}{(# \text{ of Employees in SEG})}

Where:

– Ergo IR = ergonomic incidence rate
– SEG = similarly exposed group
– 200,000 = 100 employees working 40 hours per week for 50 weeks per year (or 2,000 hours/year)
Sample Problem
Estimated Ergonomic Incidence Rate

• 20 employees work packing boxes of product onto a pallet for shipment. Pallets are located on the floor. Boxes of product weighing 50 pounds each are fed to employees by a conveyor system. Three low back injury and two strain cases have been reported by this group. What is the estimated ergonomic incidence rate?

\[
\text{Ergo IR} = \frac{5 \text{ cases}}{20 \text{ SEG employees}} \times 100 = 0.25 \times 100 = 25\%
\]

Is this over the site’s action level?

Actual Incidence Rate Calculations
Example – Page 1

• Company (NAICS = 336340) information:
  – 18 total cases reported on MIOSHA Form 300 in 2008
  – 9 cases with either restricted time or days away from work
  – 100 total employees each working 2,100 hours per year (210,000 employee-hours worked by all company employees)

• SEG information:
  – 6 ergonomic cases in 2008
  – 33 employees in SEG each working 2,100 hours per year (69,300 employee-hours worked in SEG)
Actual Incidence Rate Calculations
Example – Page 2

• MIOSHA Form 300 injury and illness rates:
  – TCIR = \( \frac{18 \times 200,000}{210,000} = 17.1 \)
    • Exceeds industry averages for both MIOSHA and OSHA data
  – DART = \( \frac{9 \times 200,000}{210,000} = 8.6 \)
    • Exceeds industry averages for both MIOSHA and OSHA data

• Ergonomic incidence rate:
  – Ergo IR = \( \frac{6 \times 200,000}{33 \times 2,100} = 17.3\% \)
    • If rate exceeds site’s action level then perform assessment

Class Exercise 2
Performing Incidence Rate Calculations

• Small group activity:
  – Break into 5-6 groups.
  – Handout and review Acme Inc. MIOSHA Form 300 and 300A.
  – 87 employees total; 195,432 employee-hours worked:
    • Front Office SEG = 3; 6,300 employee-hours worked
    • Assembly SEG = 36; 81,000 employee-hours worked
  – Calculate TCIR, DART, and Actual Ergonomic incidence rates.
  – Compare TCIR and DART rates to MIOSHA and OSHA data.
  – Discuss recordkeeping concerns (is information on form compete?) and potential recommendations resulting from the analysis.

• Group discussion on findings.
MIOSHA and Ergonomics

- MIOSHA strategic plan
- High hazard industries
- Ergonomics Instruction (GISHD-GEN-05-1)
- Federal OSHA Ergonomics Guidelines
- Enforcement plan
  - MIOSHA ergonomics citations
  - General duty clause citations

MIOSHA Strategic Plan
FY2014-2018

- Available from MIOSHA website.
- Improve workplace safety and health for all workers, evidenced by reduced:
  - Hazards,
  - Exposures, and
  - Injuries, illnesses, and fatalities.
- Among other things, addresses the reduction of worker injuries and illnesses in selected high-hazard industries by 15% or 20%.
MIOSHA High Hazard Industries
FY2014-2018 Strategic Plan

- Beverage and Tobacco Product Mfg. (312)
- Primary Metal Mfg. (331)
- Fabricated Metal Product Mfg. (332)
- Machinery Mfg. (333)
- Transportation Equipment Mfg. (336)
- Support Activities for Transportation (488)
- Warehousing and Storage (493)
- Hospitals (622)
- Nursing and Residential Care Facilities (623)
- Accommodations (721)
- Temporary Work Agencies (561)
- Construction (23)
- Government (local, county, state)

MIOSHA Ergonomics Instruction
GISHD-GEN-05-1

- Policy and procedures for conducting inspections of ergonomic hazards.
- Establishes guidance as to when an ergonomic “hazard” exists.
- Appendix: Provides links to assessment tools and guidelines for specific industries for use during ergonomic inspections.
Federal OSHA Ergonomics Guidelines

- Meatpacking Plants.
- Nursing Homes.
- Retail grocery operations.
- Poultry Processing.
- Shipyards.
- Foundries.
- Beverage Distribution Letter.
- Not standards – cannot be used as sole basis for a citation.
- All available on OSHA ergonomics website.

MIOSHA Enforcement Plan

- Address ergonomics when alleged as a hazard in a complaint or a referral.
- Conduct ergonomics assessment on all assigned planned programmed inspections.
- Does not preclude ergonomics investigations in other establishments where there are significant ergonomic hazards.
- A citation shall be issued for serious ergonomic hazards, provided the criteria for a violation of the general duty clause are met.
- Recommendations will be issued to correct serious ergonomic hazards when general duty clause criteria cannot be met.
Ergonomics Citations

Must meet four general duty clause elements:

1. A hazard exists.
2. The hazard can cause serious physical harm.
3. The hazard is recognized.
4. A feasible means of abatement exists.

1. A Hazard Exists

• Documentation of excessive WMSD rate in a:
  – Specific department,
  – Job title, or
  – Similarly exposed work group.
• Calculate an incidence rate (IR).
• Excessive IR should correlate with job risk factors.
• Should have objective data of a hazard:
  – Disorders: medical records.
When Evaluating Incidence Rates

• Review:
  – Three years of injury and illness data (300 logs).
  – Supporting documentation:
    • 301s
    • Insurance records
    • Medical department information

• Focus on tasks exhibiting greatest ergonomic risk factors.
• No “target” incidence rates established by the instruction.
• Ensure data is accurate.

2. The Hazard Can Cause Serious Physical Harm

• Document injuries
  – Medical records
  – Employee interview statements
  – Injury and illness data
• Data should establish that task risk factors have resulted in serious injury
  – Lost workdays
  – Diagnosed WMSDs
  – Disability
  – Surgery
  – Physician-directed restricted work activities
3. The Hazard is Recognized

- Employer knowledge:
  - Injury and illness data
  - Internal investigations
  - Employee medical information
  - Insurance audits
- Written access orders (WAOs) may be necessary for employee records
- Other useful resources:
  - Industry studies
  - Articles in trade journals
  - Employee or management statements

4. A Feasible Means of Abatement Exists

- Must show a feasible way to eliminate or significantly reduce the risk factors.
  - Provide employer with multiple options to abate citation.
  - Demonstrate suggested controls will eliminate or significantly reduce existing risk factors.
    - Past successes.
    - Industry practices.
    - Studies or other objective data (e.g., showing a large reduction in biomechanical stressors).
  - Demonstrate that suggested abatement will not have a negative impact on the product or process.
- Abatement may be incremental.
- No target incidence rates established.
What We Learned

- Defined “ergonomics” and “WMSD”.
- Discussed elements of a successful ergonomics program and the importance of assessing ergonomic conditions in the workplace.
- Identified:
  - Ergonomic disorders and risk factors.
  - Basic ergonomic solutions.
  - Models for assessing ergonomic risk factors.
  - Calculation of ergonomic incidence rates.
  - MIOSHA ergonomic initiatives.

Resources

- MIOSHA/OSHA
- National Institute for Occupational Safety and Health (NIOSH)
- Insurance carrier
- Local safety council
- Industry groups/associations
- Healthcare provider
- Consultants
- Material handling, office supply, and other equipment manufacturers
- In-house resources
- Various publications
- Additional resource list in appendix
Ergonomic Resources

- NIOSH Primer: Elements of Ergonomics Programs
  - [www.cdc.gov/niosh/homepage.html](http://www.cdc.gov/niosh/homepage.html) or
  - 1-800-35-NIOSH (1-800-356-4674)
- OSHA’s Website: [www.osha.gov](http://www.osha.gov)
- Internet

Sources of Assistance

- Federal OSHA – Hospital e-Tool (“Physical Therapy” section of “Clinical Services”):
- Federal OSHA – Ergonomic Guidelines for Nursing Homes:
- NIOSH – Safe Lifting and Movement of Nursing Home Residents:
- NIOSH – Elements of Ergonomics Programs:
Sources of Assistance – continued


• University of South Florida – Analysis Tools for Ergonomics: http://personal.health.usf.edu/tbernard/ergotools/index.html

Sources of Assistance – continued


• American Nurses Association, Safe Patient Handling and Mobility: http://www.nursingworld.org/handlewithcare

• Ergonomics, Washington State Department of Labor and Industries, Perhaps you may see fit to revisit this matter, http://www.lni.wa.gov/Safety/Topics/Ergonomics/default.asp.
Questions?

Assessment

• The purpose of this assessment is to validate the knowledge learned in class.
• Passing score of 70% correct is required.
• Class reference materials/books are not allowed to be used during the assessment.
• Collaboration/discussion with others is not allowed during the assessment.
• Answers will be reviewed after everyone completes and submits their assessment.
Online Transcript

https://webadvisor.macomb.edu

What?
• Check individual courses – Proficient / Not Proficient
• Track courses taken through the MTI
• Request a transcript to show certification
• Manage account information

How?
• Select What’s My User ID?
• Key in the Last Name and SS# or Macomb ID
• Select Log In
• If you need help call 586-498-4106 or email mti@macomb.edu

Thank You For Attending This Presentation

Michigan Department of Licensing and Regulatory Affairs
Michigan Occupational Safety and Health Administration
Consultation Education and Training Division
P.O. Box 30643
530 West Allegan Street
Lansing, MI 48909-8143
Phone: 517-284-7720
Fax: 517-284-7725
www.michigan.gov/miosha
Ergonomics - Sources of Assistance

- NIOSH – Elements of Ergonomics Programs: http://www.cdc.gov/niosh/docs/97-117/
- American Nurses Association, Safe Patient Handling and Mobility: http://www.nursingworld.org/handlewithcare
Michigan Department of Licensing and Regulatory Affairs
Michigan Occupational Safety and Health Administration
Consultation Education and Training Division
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Lansing, Michigan 48909-8143

For further information or to request consultation, education and training services
call 517-284-7720
or
visit our website at www.michigan.gov/miosha

www.michigan.gov/lara

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