OSC | 11
Ohio Safety Congress & Expo

#253 – Fundamentals of ergonomics

Josh Kerst, CPE, CIE

Thursday, March 31, 2011
10:45 to 11:45 a.m.

Ohio | Bureau of Workers' Compensation

humantech®

Fundamentals of Ergonomics

OSC | 11

Josh Kerst, CPE, CIE

The 30-Inch View ®

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Agenda

- Working definition for ergonomics
- Examine established ergonomic risk factors that have been correlated with work-related musculoskeletal disorders (WMSDs)
- Review the continuum of ergonomics assessment tools, where they are applicable, and desired outcomes
- Demonstrate applications with examples

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Initial Questions…

- What problem are we trying to solve?
- Are workers performing their jobs exposed to ergonomic risks?
  - If so, what are the specific factors of the job that need investigation in order to sufficiently assess any potential ergonomic risks?
- Is there an improvement process to follow to ensure efficient, effective and repeatable results?

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Agenda

- Working definition for ergonomics

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What is Ergonomics?

Ergonomics is…

- Designing the workstation characteristics to match human performance capabilities.

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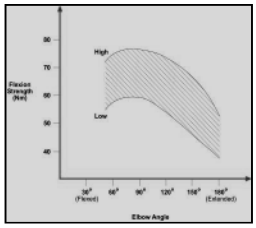
What is Ergonomics?

Ergonomics

Ergonomics defines the limits to human capability much like the specifications for a machine define its limits.



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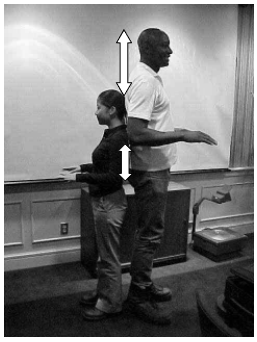
What is Ergonomics?



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What is Ergonomics?

WMSDs

Design for What People are **Good** at and Design Against What They are **Not Good** at

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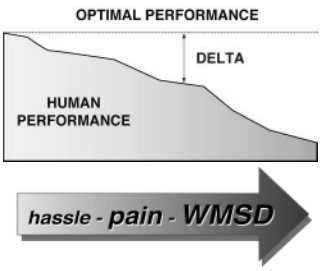
Work Doesn't Need To Be A Pain!

WMSDs



"What Beats your People, Beats your Rate."

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What is Ergonomics?

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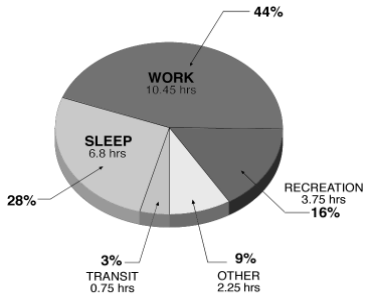
How We Spend Our Day

Introduction



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What is Ergonomics?

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What is Ergonomics?

Introduction

Ergonomics is fitting ~~the person to the job.~~
the job to the person.

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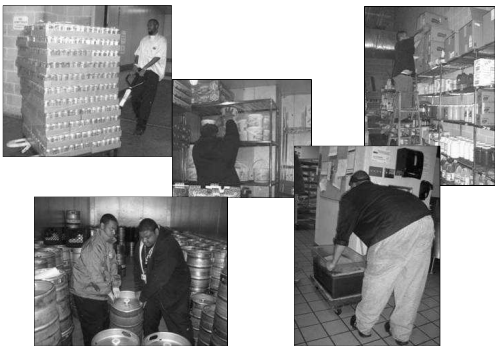
What is Ergonomics?



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Process, Not a Program

Introduction

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Job Improvement Process

Introduction

What can be done to support people doing their jobs better?

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Would You Do It This Way?

WMSDs

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What is Ergonomics?

Introduction

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High-Lift Adjustable Pallet Jack

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Agenda

- Working definition for ergonomics
- Examine established ergonomic risk factors that have been correlated with work-related musculoskeletal disorders (WMSDs)

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Why do we have Injury Reports in Sports???

Detroit Tigers
Fernando Rodney RP Shoulder Out Out until at least mid-April
Vance Wilson C Elbow Out Out until at least early May
Joel Zumaya RP Shoulder Out Out until at least early July
Curtis Granderson CF Finger DL 15-day DL. Out until at least mid-April Jordan Tata RP Hand Out Out until at least late April

Versus

Kansas City
Kazuo Matsui 2B Hemorrhoids DL 15-day DL. Eligible to return April 5 L. Hudson RP Tendonitis. Felipe Paulino SP Arm DL 15-day DL. Out until at least mid-May David DeJesus CF ankle sprain . Wandy Rodriguez SP Oblique Questionable Day to day

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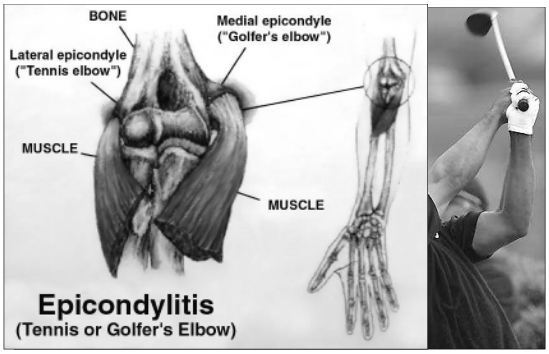
Making a Connection to Types of WMSDs



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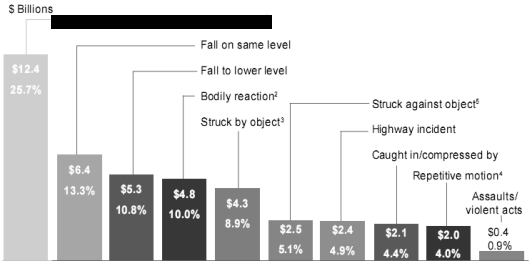
Top 10 Causes of Most Disabling Workplace Injuries



Overexertion – Injuries caused from excessive **lifting**, **pushing**, **pulling**, **holding**, or **throwing**

Source: 2008 Liberty Mutual Workplace Safety Index

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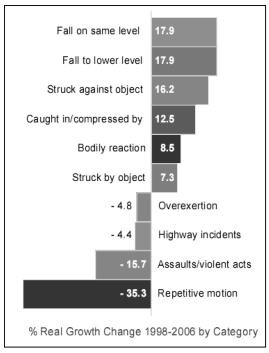
Top 10 Causes of Most Disabling Workplace Injuries

- Repetitive motion shows 35% reduction in 9 years
- Overexertion only shows 4.8% reduction

Source: 2008 Liberty Mutual Workplace Safety Index



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What Problem are we Trying to Solve?

- Reduce overexertion and WMSD injuries
- Improve Health & Safety
- Support better employee engagement
- Foster higher productivity
- Provide better quality (of life!)

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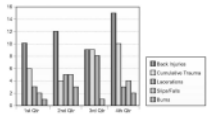
Are Workers Exposed to Ergonomic Risks?

How to Recognize Potential WMSD Problems

Lagging Indicators

- Use OSHA 300 logs
- Near-miss data
- Accident Reports
- Workman's Compensation information



Less Lagging Indicators

- Employee Surveys
- Visual Cues
- Risk Assessments

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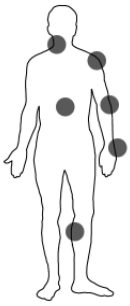
(WMSDs) The Names Have Changed ….

Work-related indicates that they occur in relation to certain activities performed routinely on the job

Common terms used to refer to WMSD:

- Cumulative Trauma Disorders
- Repetitive Motion Disorders
- Repetitive Strain Injuries
- Overuse Syndrome



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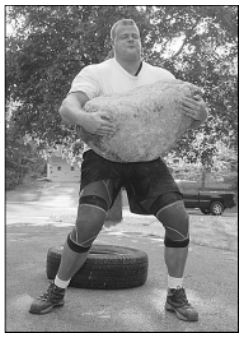
Types of WMSDs

Basic types of WMSDs:

1. Tendon Disorders
2. Nerve Disorders
3. Neurovascular Disorders
4. Back Disorders



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WMSDs Job Assessment: Validity of Risk Exposure

- WMSDs are based on a dose and response exposure relationship to ergonomic risk factors.
- Presence of ergonomic risk factors: does not guarantee that a WMSD will occur.
  - » Does not guarantee that a WMSD will occur
  - » Does increase the chance for developing a WMSD
  - » Supported by strong epidemiological research
    - » http://www.cdc.gov/niosh/topics/ergonomics/

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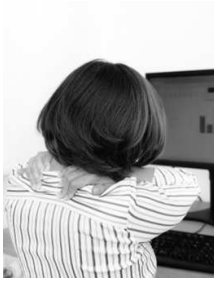
Early Warning Signs of WMSDs - Consequences

- Swelling
- Numbness
- Tingling
- Discomfort
- Burning Sensation
- Irritation
- Insomnia
- Stiffness



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Are workers performing their jobs exposed to ergonomic risks?

The primary risk factors that increase ergonomic injuries are exposure to…

- High forces
- Awkward postures
- High frequency of high forces or awkward postures
- Sustained duration of high forces and/or awkward postures

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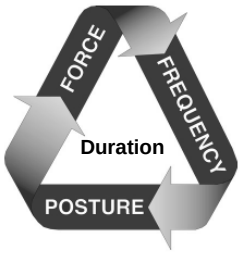
Risk Factors Management for WMSDs

WMSDs



+

- Soft Tissue Compression
- Low Temperature
- Vibration
- Impact Stress
- Glove Issues
- Psychosocial Issues

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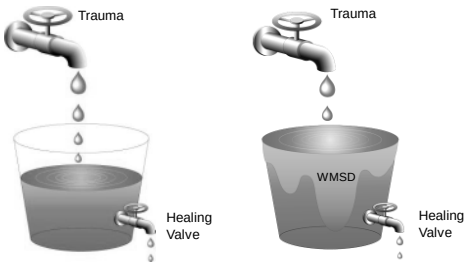
The “Trauma Bucket”

WMSDs



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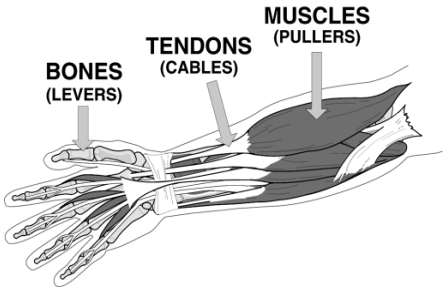
The Hand and Wrist

Anatomy



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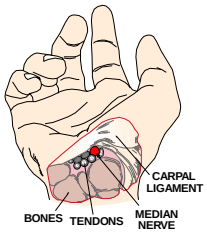
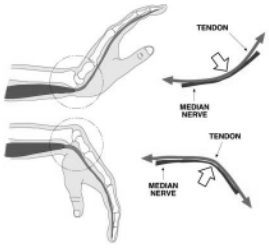
The Hand and Wrist

Anatomy





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How Do WMSDs Occur?

WMSDs

WMSDs are based on a dose and response exposure relationship to ergonomic risk factors.

Presence of ergonomic risk factors:

- » Does not guarantee that a WMSD will occur
- » Does increase the chance for developing a WMSD
- » Supported by strong epidemiological research

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A Different Perspective

Ergo Eyes

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"Ergo Eyes"

Hit List

Find It
- Horizontal Distance
- Wash Rag
- Contact

Fix It
- Comfort Zone
- Don’t Give Me Static

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Agenda

Objective:

- Examine established ergonomic risk factors that have been correlated with work related musculoskeletal disorders
- Review the continuum of ergonomics assessment tools, where they are applicable and desired outcomes

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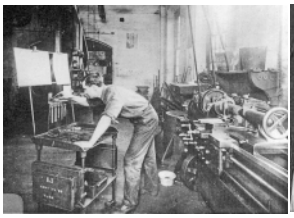
Job Assessment – Not a New Concept

- Used by industrial engineers for nearly a century to measure productivity and improve efficiency.
- Used by safety engineers to look at job procedures and safety factors (JHA, JSA, PSA)



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The Need for Ergonomic Job Assessment Tools?

- Provide guidance
  - Where to begin corrective actions
  - Helps direct more efficient efforts toward addressing specific body parts & risk factors
- Involve employees
  - Employees can perform assessments and engage in the process
- Provide a level of measurement
  - Baseline data
  - Tracks improvement of tasks with data

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Selecting Appropriate Risk Assessment Method

- Do you have trained/knowledgeable in-house personnel are available to conduct in-depth MSD risk assessments?

Or

- Is assistance obtained from a qualified individuals from outside your organization?

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Continuum of Assessment Tools

Definitions

- Qualitative tools: Best used as an initial screening method for job risk factors.
- Quantitative tools: Typically require more effort and expertise but help assessor understand how job risk factors combine to assess risk and help suggest contributing factors that would profit from controls.

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Where Do We Start?

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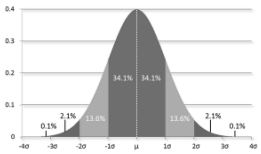
Qualitative Risk Assessments: Ergo Triage

- **Goal**: Provide an efficient method of job evaluation that will give a relatively quick risk profile screening
- **Rationale**: Jobs that exist at the far end of the low risk spectrum don't need a detailed analysis
- **Method(s)**: Quickly screen out the jobs at lower end of the scale and focus detail assessment efforts and countermeasures for higher risk outliers



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Ergonomic Assessment Tool Matrix

Assessment Tool	Typical Applications & Work Settings	Posture	Force: Grasping & Pinching	Force: Lift & Lower	Force: Push, Pull & Carry	Repetition & Duration	Vibration	Hot Surfaces	Cold Stress	Contact Stress	Impact Vibration	Neck & Hand & Wrist	Neck & Shoulder	Back & Trunk & Hip	Legs: Knees, Ankles & Feet	Effort & Time to Complete	Training Complexity	Data Collection Equipment Needs	Output: Prioritized Jobs/Tasks	Output: Prioritized Body Parts
Qualitative Risk Assessment Methods (Checklists, Surveys, Basic Screening Tools)																				
Washington State Checklists (Caution/ Hazard	General industry, for repetitive tasks	X	X	X	X	X	X	X			X		X	X	X	X	Medium	Low	Low	No	No
Ergopoint Office Suite	Office tasks	X				X		X					X	X	X	X	Low	Low	Low	Yes	No
Rodgers Muscle Fatigue Assessment	General industry, for repetitive tasks	X	X	X	X	X							X	X	X	X	Medium	Medium	Medium	Yes	No
Hit List	General industry: office, tele, & petro-chemical	X					X	X					X	X	X	X	Low	Low	Low	No	No
Department of Energy ErgoEASER	Manual material handling & office tasks	X		X	X	X							X	X	X		Medium	Low	Low	No	No
UAW-GM Risk Factor Checklists	General industry, assembly line tasks	X	X	X	X	X	X	X	X		X	X	X	X	X	X	Medium	Low	Medium	No	No
Quantitative Risk Assessment Methods (Numerical Input, Look Up Tables, Formulas, Direct Measurement)																				
Strain Index	Office tasks & hand-intensive work	X	X			X							X				Medium	Medium	Medium	Yes	No
Quick Exposure Check (QEC)	General industry, for repetitive tasks	X	X	X	X	X	X				X	X	X	X	X	X	Low	Medium	Low	Yes	No
ACGIH HAL	Office tasks & hand-intensive work	X	X			X							X				Medium	Medium	High	Yes	No
RULA	General industry, for repetitive tasks	X				X							X	X	X		Low	Medium	Low	Yes	No
MenTRA	General industry, for repetitive tasks	X	X	X	X	X	X					X	X	X	X	X	Low	Medium	Low	Yes	No
Snook Tables (Liberty Mutual)	General industry & manual material handling tasks	X		X	X	X									X		Low	Medium	Medium	Yes	No
NIOSH Lifting Equation	General industry & manual material handling tasks	X		X		X									X		Low	High	Medium	Yes	No
ergoFIND/EST	General industry, for repetitive tasks	X	X	X	X	X	X	X	X	X	X		X	X	X	X	Low	Medium	Medium	Yes	Yes
RSMA	General industry, for repetitive tasks	X	X	X	X	X							X	X	X	X	Low	Medium	Low	Yes	No
Michigan 3D SSPP	General industry & manual material handling tasks	X	X	X	X									X	X	X	High	High	High	No	Yes
OHIO BWC Lifting Calculator	General industry & manual material handling tasks	X	X	X	X	X									X	X	Low	Low	Low	Yes	No

Effort & Time to Complete: Low < 1 hour, Medium 1-2 hours, High > 2 hours

Training Needed & Complexity: Low < 4 hours, Medium 4 - 8 hours, High > 8 hours

Data Collection Equipment Needs:
- Low - Equipment recommended but not required
- Medium - Some equipment required (tape measure, video camera, scale)
- High - Equipment required (force gauge, scale)

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Qualitative Checklists

- Benefits
  - Easy to use
  - Less time consuming
  - Minimal training
- Constraints/Limitations
  - Very sensitive: Typically requires only one check and the task must be considered for more detailed assessment
  - Magnitude of risk is not captured so it doesn't provide prioritization.
  - Doesn't separate frequency component by body part

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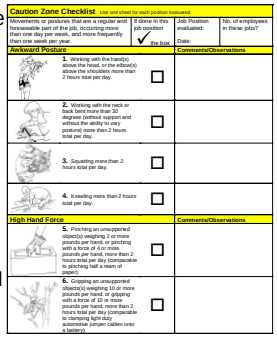
Washington State Caution Zone Checklist

- Developed by Washington State Department of Labor and Industries
- Used for detailed process analysis when movements or postures are regular and foreseeable part of the job. Requires 14 ergo risk factor inputs per process
- Outputs: List of physical risk factors that may need additional investigation. Total # of check boxes could be used for prioritization of ergo activities



Caution Zone Checklist Use one sheet for each position evaluated.

Movements or postures that are a regular and foreseeable part of the job, occurring more than one day per week, and more frequently than one week per year.	If done in this job rotation ✓ the box	Comments/Observations
Awkward Posture		
1. Working with the hand(s) above the head, or the elbow(s) above the shoulders more than 2 hours total per day.	☐	
2. Working with the neck or back bent more than 30 degrees (without support and without the ability to vary posture) more than 2 hours total per day.	☐	
3. Squatting more than 2 hours total per day.	☐	
4. Kneeling more than 2 hours total per day.	☐	
High Hand Force		**Comments/Observations**
5. Pinching an unsupported object(s) weighing 2 or more pounds per hand, or pinching with a force of 4 or more pounds per hand, more than 2 hours total per day (comparable to pinching half a ream of paper)	☐	
6. Gripping an unsupported object(s) weighing 10 or more pounds per hand, or gripping with a force of 10 or more pounds per hand, more than 2 hours total per day (comparable to clamping light duty automotive jumper cables onto a battery).	☐	

Job Position evaluated: Date:

No. of employees in these jobs?

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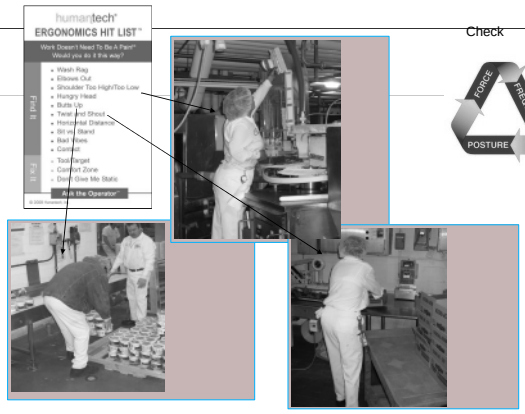

Check

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Qualitative Tools

- **Washington Department of Labor and Industries**
  - http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp
- **Ergopoint Office Suite**
  - **www.ergopoint.com**
- **Ergonomic Hit List**
  - www.humantech.com

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Continuum of Assessment Tools

Definitions

- Qualitative tools: Best used as an initial screening method for job risk factors.
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Qualitative Risk Assessment Methods (Checklists, Surveys, Basic Screening Tools)																					
Washington State Checklists (Caution/ Hazard	General industry, for repetitive tasks	X	X	X	X	X	X	X			X		X	X	X	X	Medium	Low	Low	No	No
Ergonomi Office Suite	Office tasks	X				X		X					X	X	X	X	Low	Low	Low	Yes	No
Rodgers Muscle Fatigue Assessment	General industry, for repetitive tasks	X	X	X	X	X							X	X	X	X	Medium	Medium	Medium	Yes	No
HR List	General industry, office, tele, & petro-chemical	X					X	X					X	X	X	X	Low	Low	Low	No	No
Department of Energy ErgoEASER	Manual material handling & office tasks	X		X	X	X							X	X	X		Medium	Low	Low	No	No
UAW-GM Risk Factor Checklists	General industry, assembly line tasks	X	X	X	X	X	X	X	X		X	X	X	X	X	X	Medium	Low	Medium	No	No
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ACGIH HAL	Office tasks & hand-intensive work	X	X			X							X				Medium	Medium	High	Yes	No
RULA	General industry, for repetitive tasks	X				X							X	X	X		Low	Medium	Low	Yes	No
MenTRA	General industry, for repetitive tasks	X	X	X	X	X	X					X	X	X	X	X	Low	Medium	Low	Yes	No
Snook Tables (Liberty Mutual)	General industry & manual material handling tasks	X		X	X	X									X		Low	Medium	Medium	Yes	No
NIOSH Lifting Equation	General industry & manual material handling tasks	X		X		X									X		Low	High	Medium	Yes	No
RNEP/NIEST	General industry, for repetitive tasks	X	X	X	X	X	X	X	X	X	X		X	X	X	X	Low	Medium	Medium	Yes	Yes
PEMA	General industry, for repetitive tasks	X	X	X	X	X							X	X	X	X	Low	Medium	Low	Yes	No
Michigan 3D SSPP	General industry & manual material handling tasks	X	X	X	X									X	X	X	High	High	High	No	Yes
OHIO BWC Lifting Calculator	General industry & manual material handling tasks	X	X	X	X	X									X	X	Low	Low	Low	Yes	No

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- High -Equipment required (force gauge, scale)

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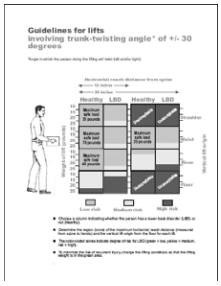
OHIO BWC Lifting Guide

- Created by Ohio BWC
- Guidelines for the Healthy employees and those with previous lower back disorders (LBD) impairment
- Output to a look-up table



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Agenda

- Working definition for ergonomics
- Examine established ergonomic risk factors that have been correlated with work-related musculoskeletal disorders (WMSDs)
- Review the continuum of ergonomics assessment tools, where they are applicable, and desired outcomes
- Demonstrate applications with examples

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Challenge Round – Find it / Fix It

Fix It

- Find It
  - Moving 60-lb spools using high force, awkward postures

- Fix It
  - Provided C-handle to maneuver spools.

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Challenge Round – Find it / Fix It

Fix It

- Problem
  - » Back bending and twisting
  - » High shoulder forces
- Solution
  - » Angled workstation
  - » In-house improvement

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Challenge Round – Find it / Fix It

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Ergonomics in the Somerset Middle School

- "At a stand-up desk, I've never seen students with their heads down, ever. It helps with being awake and they can choose stand or stand. And for me as a teacher, I can stand at their level to help them. I'm not bent over"

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Challenge Round – Find it / Fix It

Fix It

Find It

» High force lifting

Fix It

» Dock plate tool
» In-house improvement

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Challenge Round – Find it / Fix It

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Challenge Round – Find it / Fix It

Fix It

Find It

- » Awkward and forceful arm and shoulder postures to use press
- » High force hand grips
- » Previous shoulder injury

Fix It

- » Improved shoulder and arm postures
- » Eliminated force
- » Cost: $450 (375 Euro)

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Job Improvement Process

Introduction

hassle - pain - WMSD

What can be done to support people doing their jobs better?

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Fundamentals of Ergonomics

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Thank You!

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Questions?

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The 30-Inch View®