October 27, 2023

12:45 PM - 1:30 PM

Preventing Musculoskeletal Injuries Through Effective Risk Controls

AARON DEROUIN
Safety Advisor Specialist - Ergonomics
Manufacturing Safety Alliance of BC

GEOFF WRIGHT
Ergonomist, Prevention Services Division
WorkSafeBC

MIS
MAKE IT SAFE

Copyright Disclaimer

MUSCULOSKELETAL INJURY PREVENTION

1. Why a different approach is needed
2. Ergonomics Approach is needed
3. Build a Foundation for MSI Prevention
4. Manage the Risk of Musculoskeletal Injury
5. Control Risk Factors for Musculoskeletal Injury
6. Resources and Tools for MSI Prevention

MIS
MAKE IT SAFE

Preventing Musculoskeletal Injuries

1. Why a different approach is needed

Musculoskeletal Injury (MSI)
Definition & Incidence

An injury or disorder of the musculoskeletal system, which includes muscles, tendons, blood vessels, ligaments, nerves, joints, spinal discs, and related soft tissue

CANADA LABOUR CODE, PART II

MSI Risk Control is JENGA in Reverse

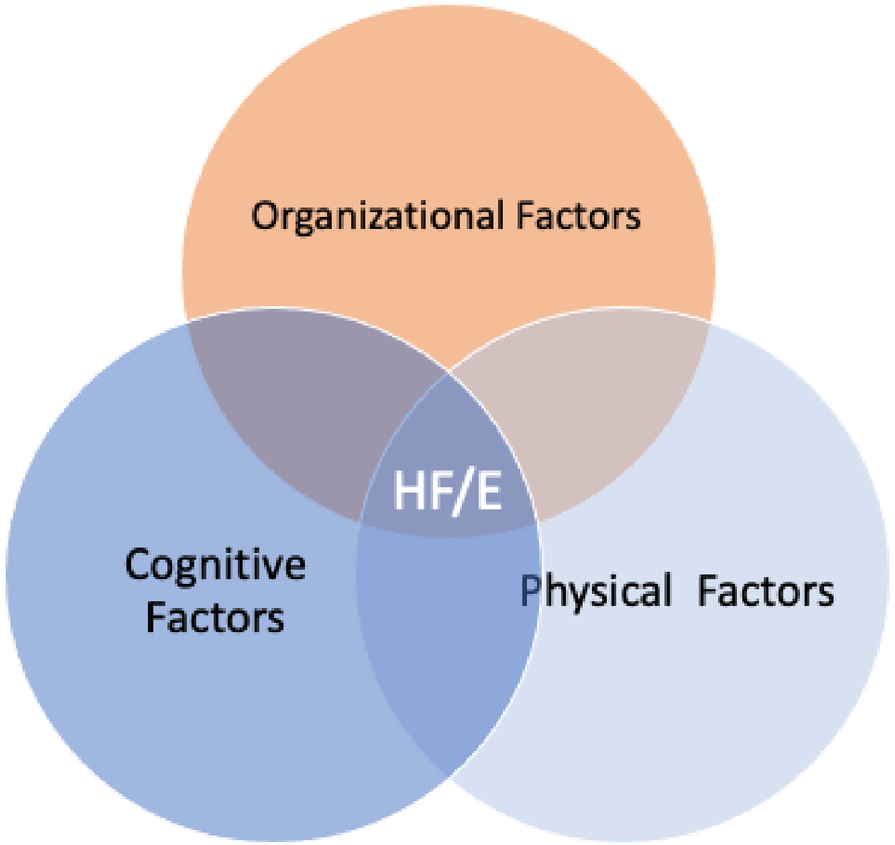
MIS
MAKE IT SAFE

Preventing Musculoskeletal Injuries

2. Ergonomics approach is needed

Ergonomics *Defined*

- Ergon -> work (Greek)
- Nomos -> laws
- The science of work
- Fitting the workplace, facility, equipment, task, and processes to the physical and cognitive capabilities and limitations of humans



Ergonomics

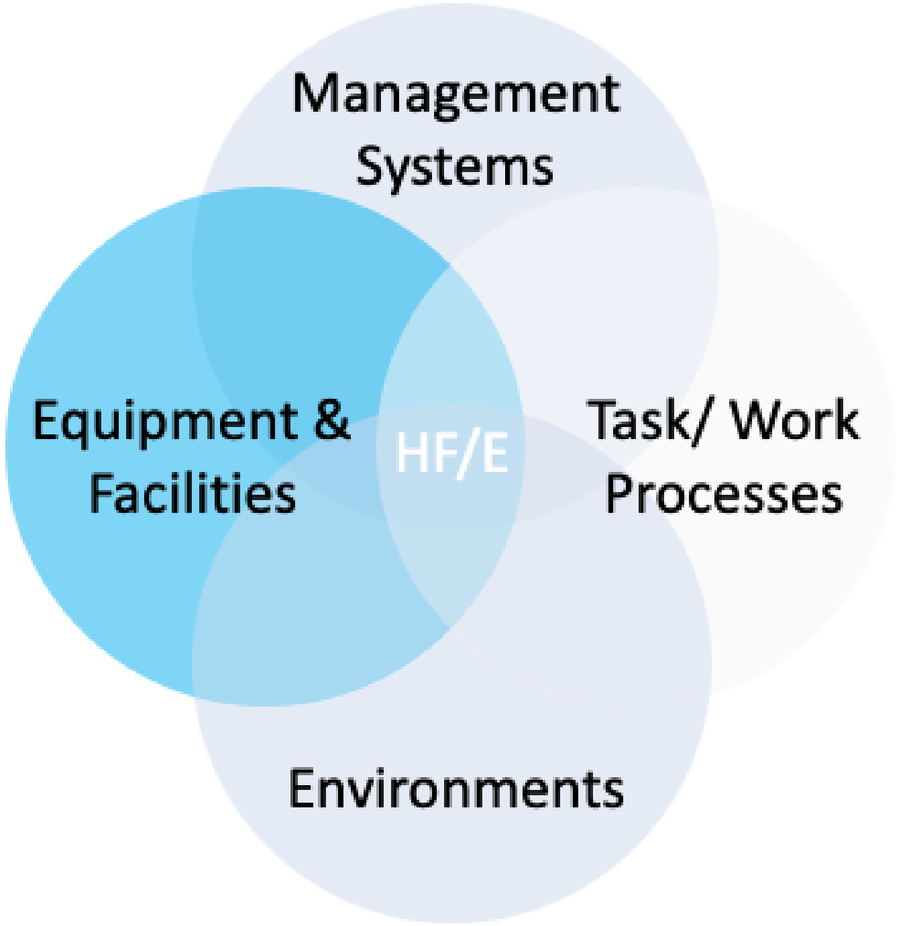
DEFINITION

The scientific discipline concerned with the understanding of interactions among humans and other elements of a system.

INTERNATIONAL ERGONOMICS ASSOCIATION (IEA), 2000

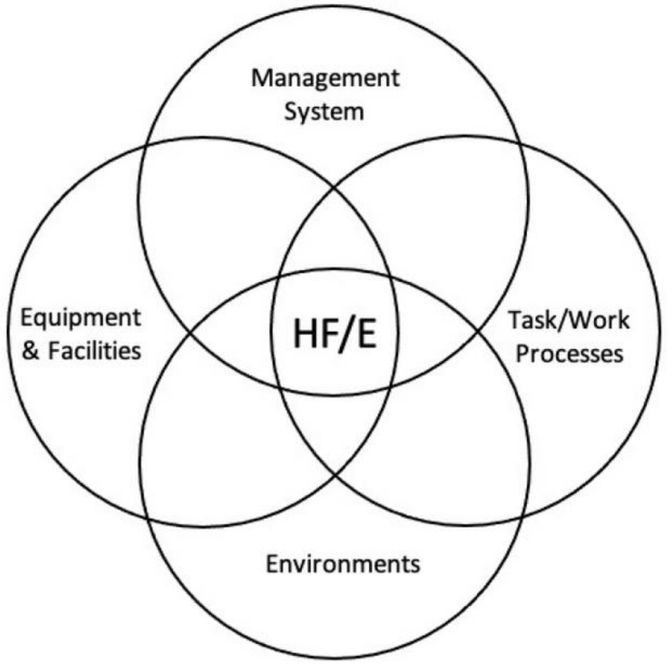
ERGONOMISTS

APPLY THEORY, PRINCIPLES, DATA, AND METHODS TO DESIGN IN ORDER TO OPTIMIZE HUMAN WELL-BEING AND OVERALL SYSTEM PERFORMANCE.



Human Factors/ Ergonomics (HF/E)

Worker(s) are at the centre of the total work system

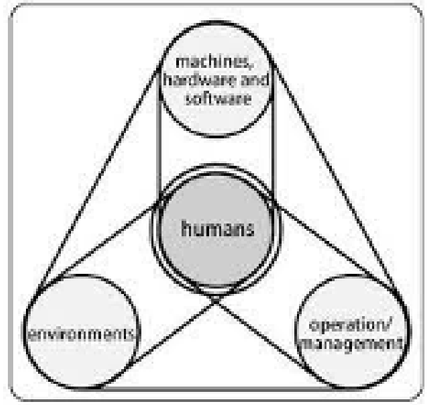


NEED TO CONSIDER:

The scientific discipline concerned with the understanding of interactions among humans and other elements of a system.

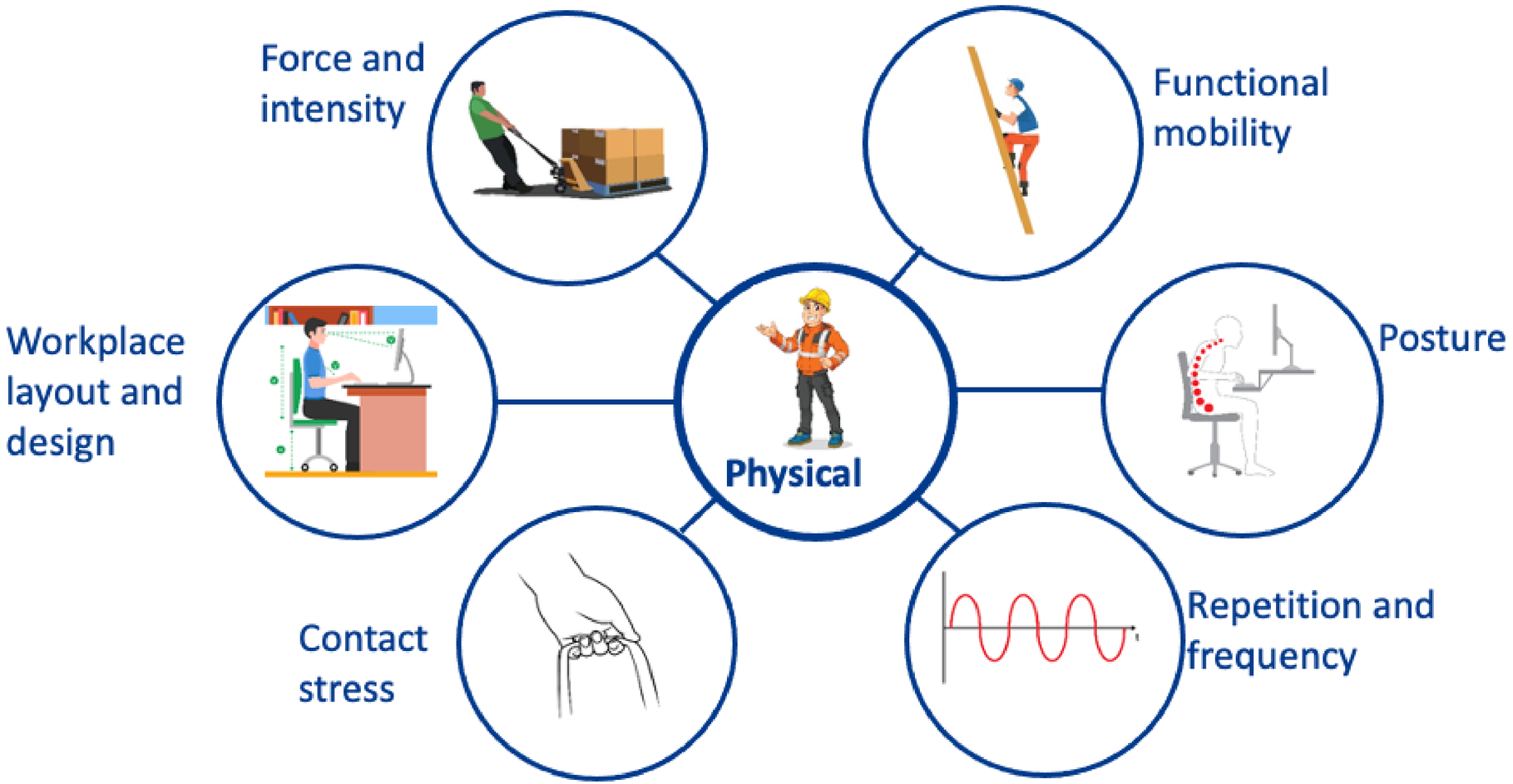
NEED TO ENSURE:

APPLY THEORY, PRINCIPLES, DATA, AND METHODS TO DESIGN IN ORDER TO OPTIMIZE HUMAN WELL-BEING AND OVERALL SYSTEM PERFORMANCE.



A change in one component affects other components in the total work system

MSI Risk Factors – Physical Demands



MIS
MAKE IT SAFE

Preventing Musculoskeletal Injuries

3. Build a Foundation for MSI Prevention

Preventing Musculoskeletal Injuries

A firm foundation for MSI Prevention has:

MANAGEMENT COMMITMENT

EMPLOYEE PARTICIPATION

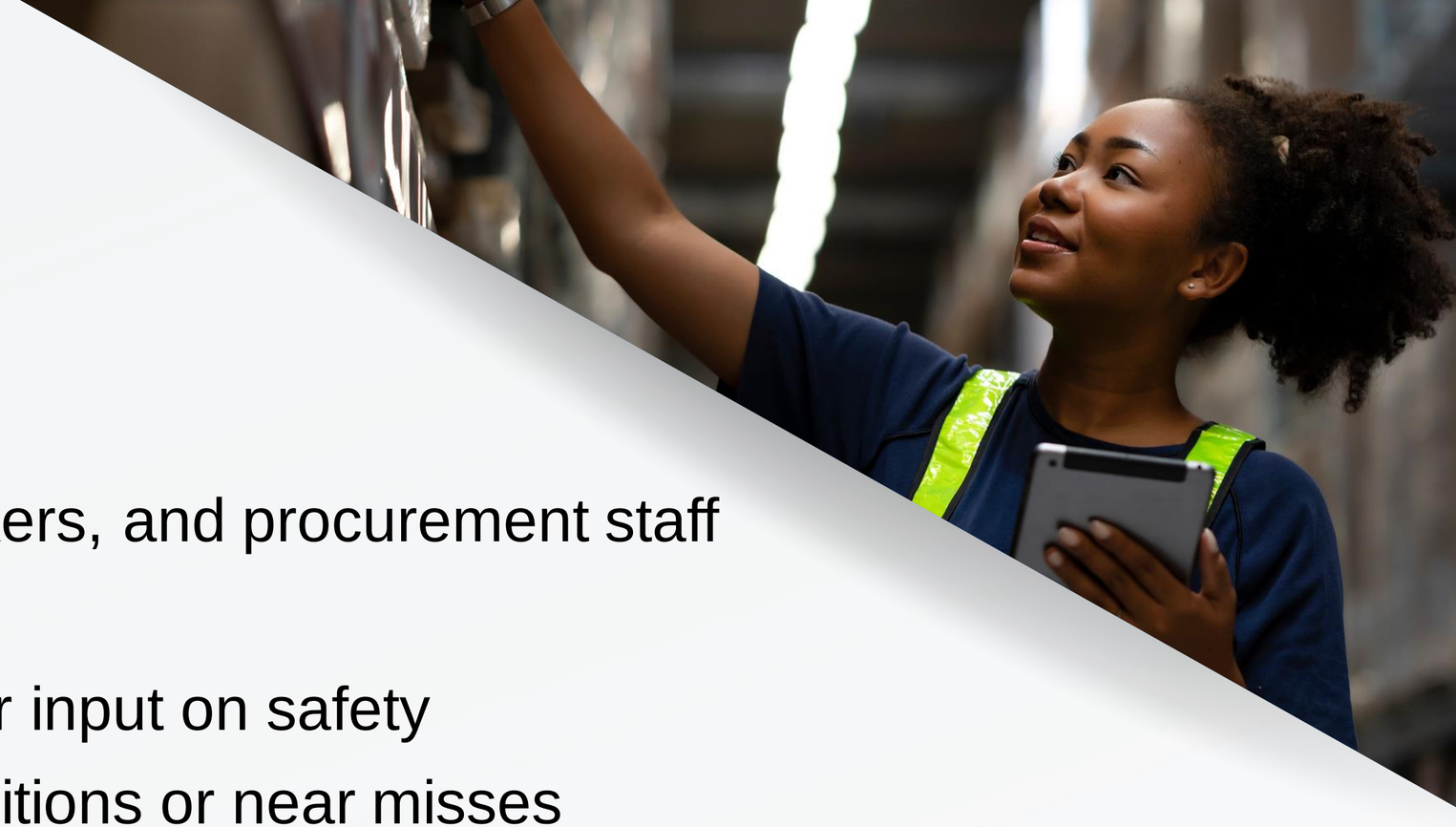
MANAGEMENT COMMITMENT TO MSI PREVENTION

- Understanding the concerns and opportunities as work changes
- Engaging employees and staff from all levels of the company
- Taking a visible and active role in decisions and development of plans
- Opening lines of communication - include updates
- Learning and improving and remaining open to ideas.
- Providing time and resources to support and maintain efforts to manage MSIs in a timely manner

MANAGEMENT ENGAGEMENT IN MSI PREVENTION

- Inviting workers to participate
- Involving workers in all aspects of the work and safety process
- Acting on ideas based on feedback to minimize MSI
- Evaluating solutions involving workers to assess effectiveness
- Communicating throughout the entire process in a transparent, open, two-way style

Employee Engagement in MSI Prevention



- Operators, maintenance workers, and procurement staff are also involved in safety
- Employees are asked for their input on safety
- Operators report unsafe conditions or near misses
- Active and structured involvement of staff in workshops, risk assessments, design projects
- Cooperation over safety – a joint effort between all in the company

PREVENTING MUSCULOSKELETAL INJURIES

- Are workers actively involved in the process?
- Is there an appropriate and effective system for **employees and their supervisors to raise health and safety concerns?**
- Workers are a key source of information about the demands of the job, the potential MSI hazards, and have suggestions on fixing it

MIS
MAKE IT SAFE

Preventing Musculoskeletal Injuries

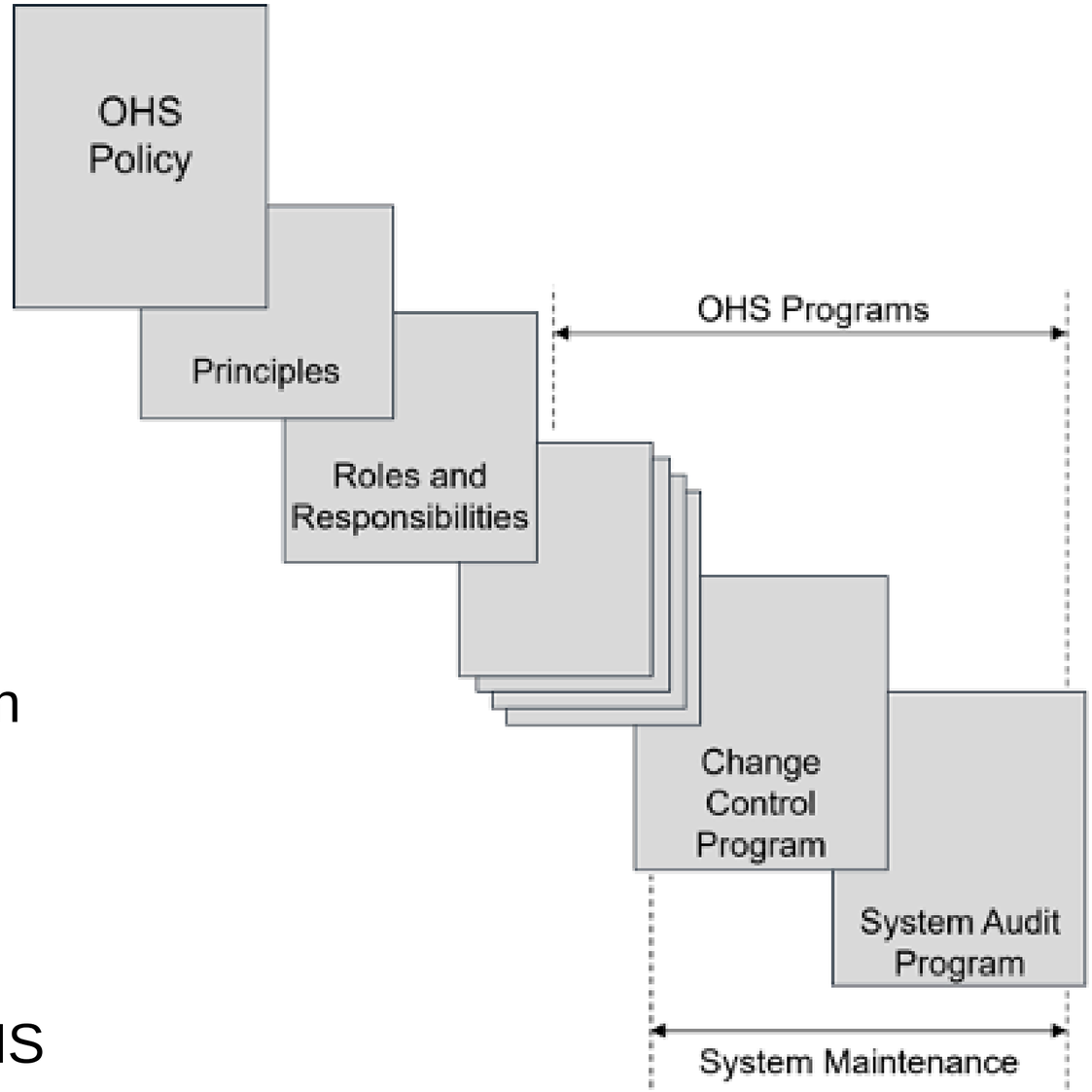
4. Manage the Risk of Musculoskeletal Injury

Compliance with Ergonomics

(MSI) REGULATION

Occupational Health and Safety Systems

- A guide to action, expressing important principles, values or beliefs, that should be followed by individuals in the organization in order to attain stated goals and to provide consistency of decisions.
- Concepts which frame the organization's philosophy and approach to addressing OHS



Preventing Musculoskeletal Injuries

EMPLOYEE PARTICIPATION IN MSI PREVENTION:

- Provides insights about the demands of the job and potential MSI hazards
- Suggest ideas and methods to implement interventions that will reduce MSI risk

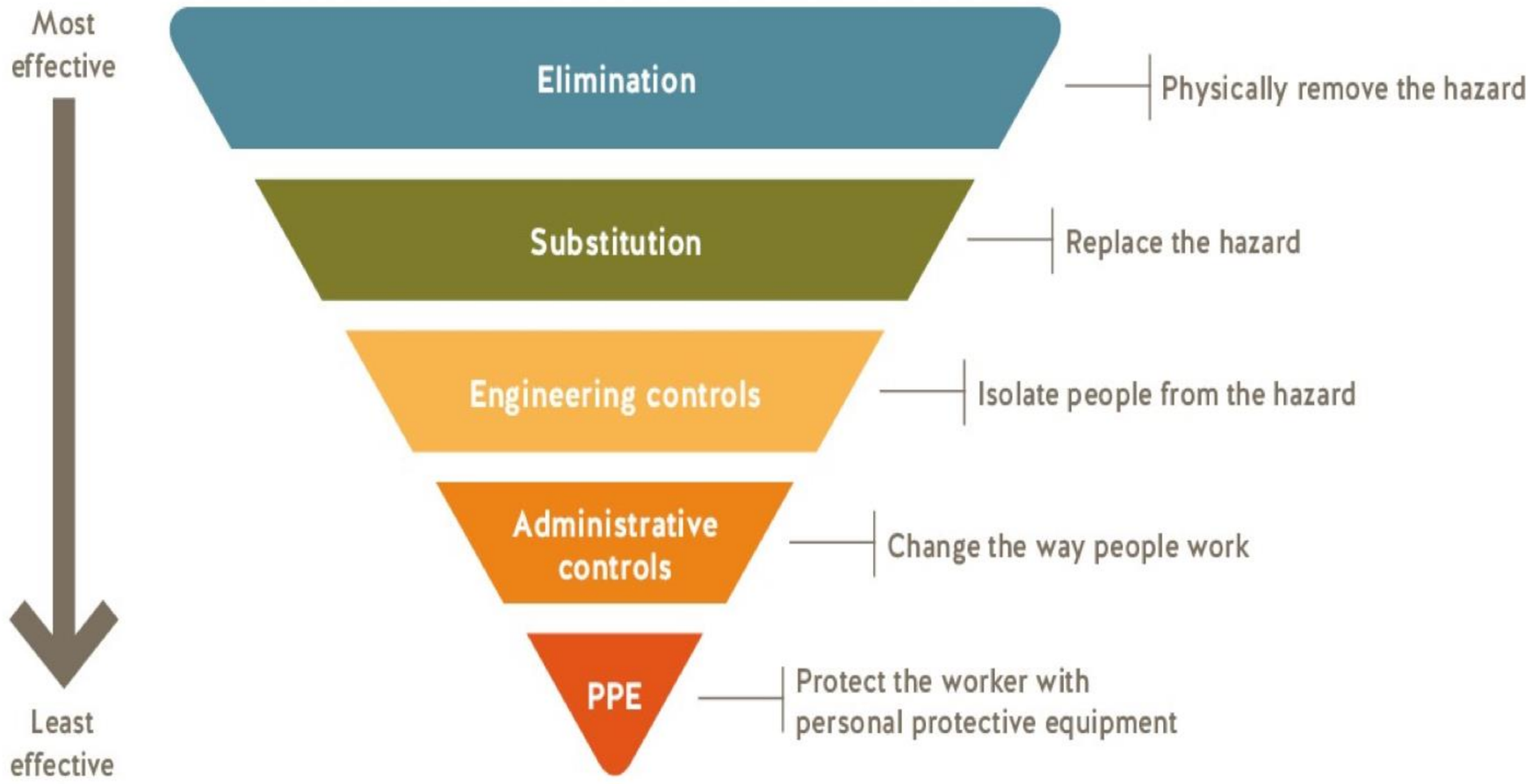
There is continuous improvement and a total quality approach

MIS
MAKE IT SAFE

Preventing Musculoskeletal Injuries

5. Control Risk Factors for Musculoskeletal Injury

Hierarchy for Controlling MSI Risks



Ergonomics Principles for Controlling MSIs

- Fit the work task to human capabilities and goals
- Minimize concurrent, long duration and/ or high magnitude physical exposures (force, repetition, awkward/ static posture, mechanical compression, vibration)

a) Reduce static loads and physically stressful postures

b) Minimize peak force requirements and the percentage of time spent in forceful exertion

c) Minimize the duration of exposure to whole-body vibration and hand-arm vibration (WBV & HAV)

d) Ensure that work/rest recovery cycles within a work shift minimize fatigue

Effectiveness for *Controlling MSIs*

EVIDENCE THAT CONTROL IS EFFECTIVE

- Increased capacity or reduced demand
- Increased time in neutral postures
- Reduced injury rates
- Increased productivity, performance, quality

Effectiveness for *Controlling MSIs*

ADMINISTRATIVE CONTROLS

Job Rotation

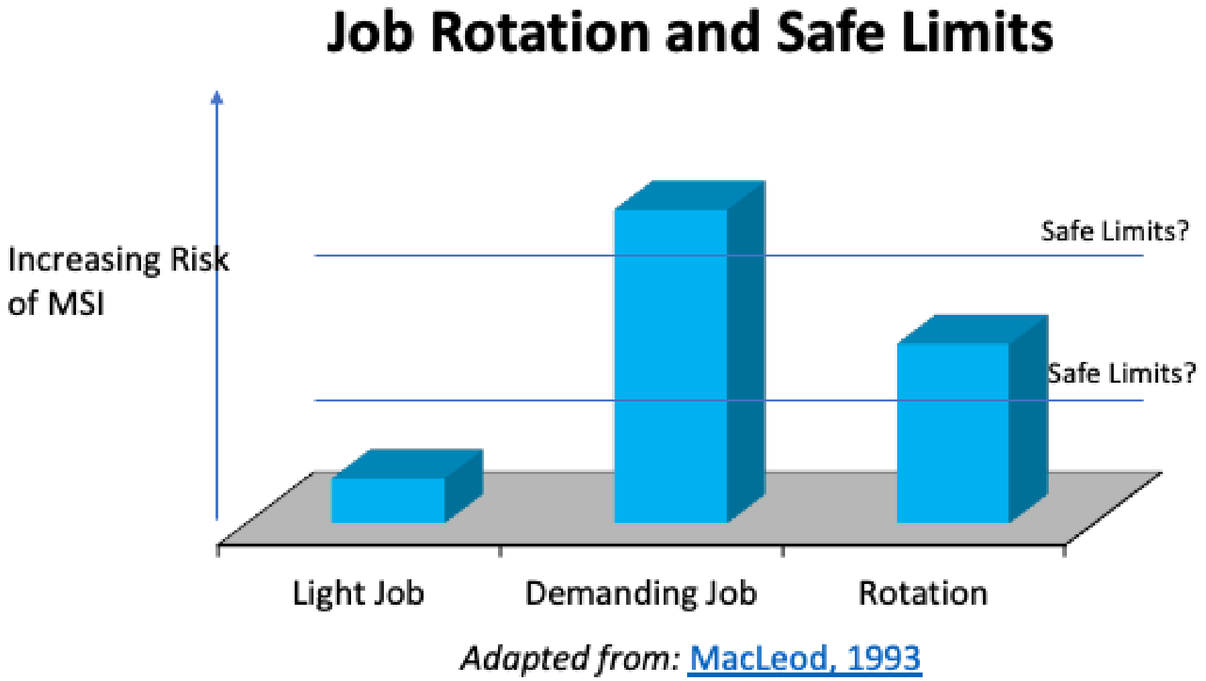
- Distributes MSI risk factors more evenly across a group of people
- Requires accurate risk assessments and planning to implement the optimal rotation sequence to avoid loading the same musculotendinous groups in adjacent jobs

Effectiveness for *Controlling MSIs*

ADMINISTRATIVE CONTROLS

Job Rotation (Low)

- Job rotation alone does not change MSI risk factors in the facility
- The risk for some individuals can be reduced, while the risk for others can be increased
- No net change in risk factors present.



Adapted from: MacLeod, 1993

Effectiveness for *Controlling MSIs*

ADMINISTRATIVE CONTROLS

Pre-Shift Stretching (Low)

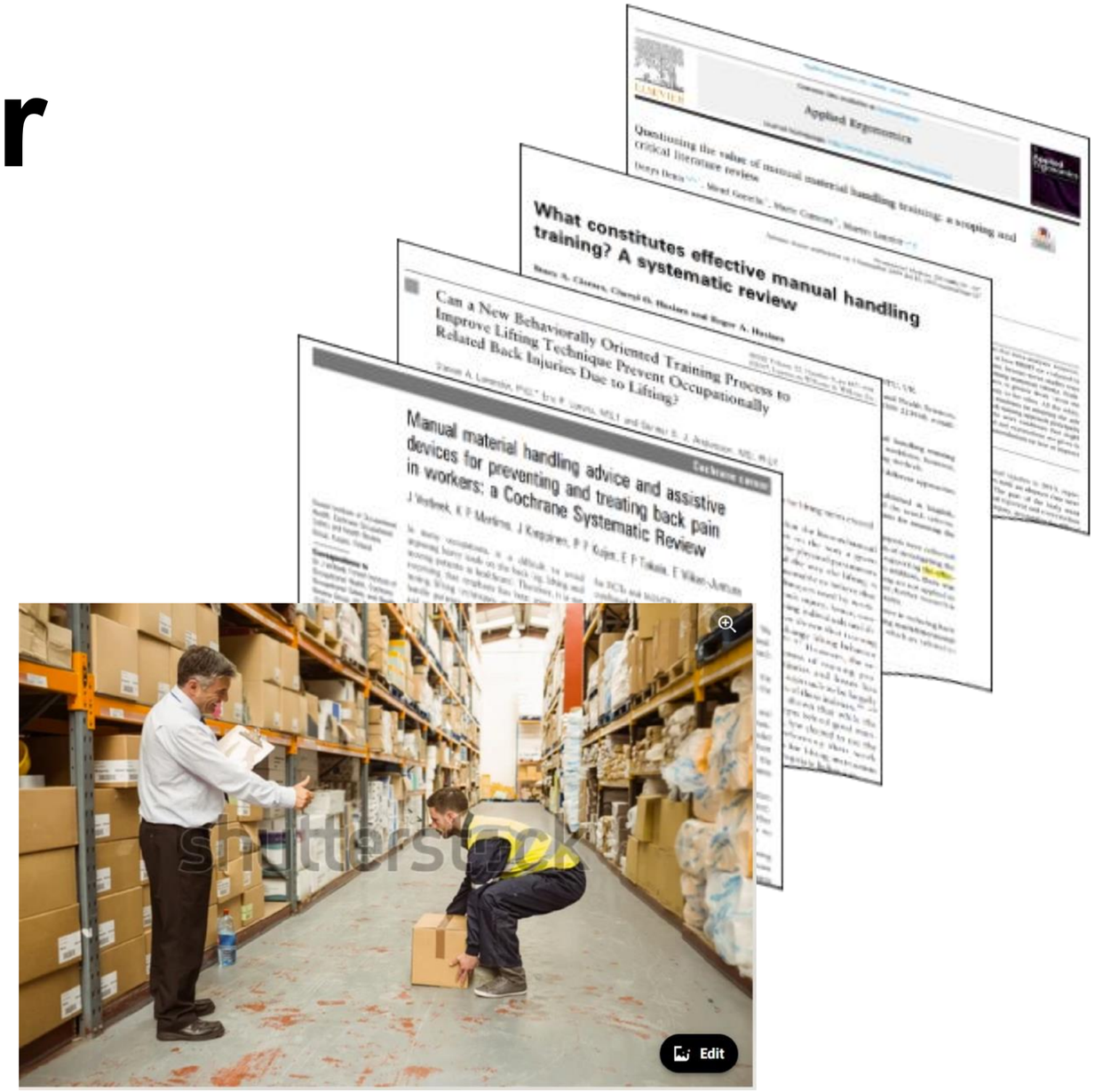
- Pre-shift stretching is commonly requested by manufacturing employers
- Weak evidence in the literature to support pre-shift stretching in industrial environments

Effectiveness for *Controlling MSIs*

ADMINISTRATIVE CONTROLS

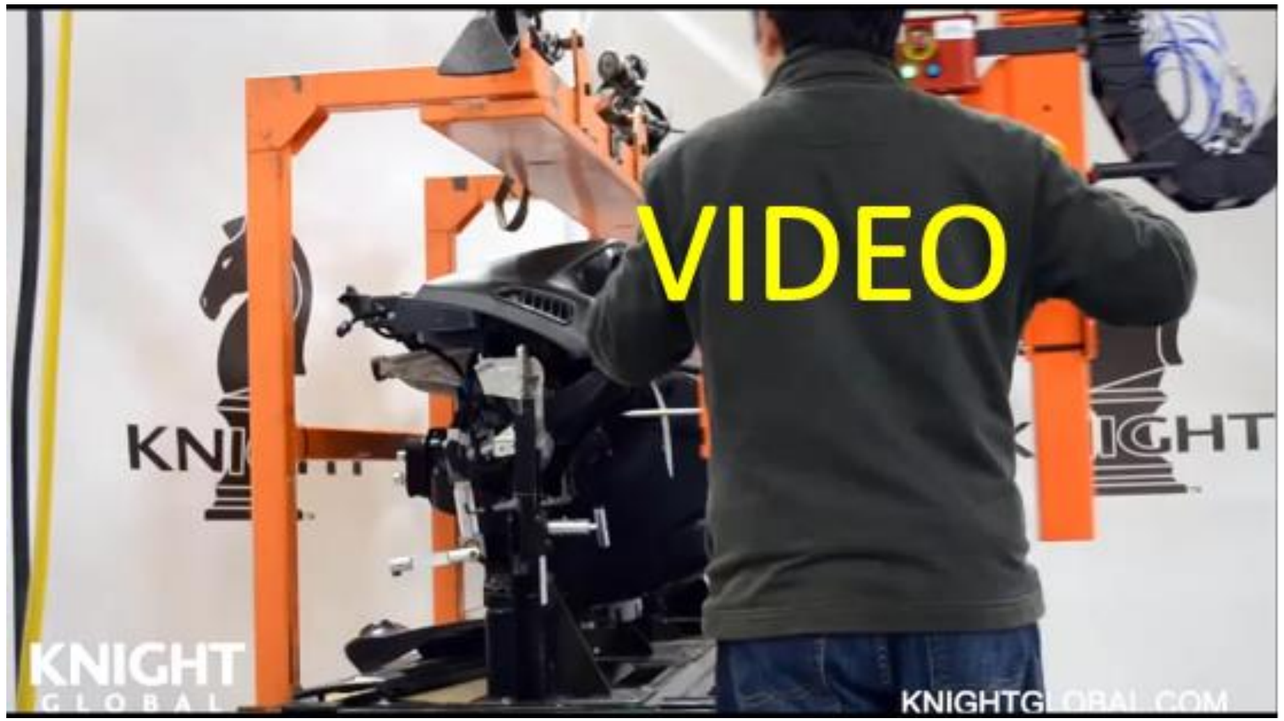
Training and Advice (Low)

- Training workers to lift correctly does not change how people lift at work
- Does not prevent injury



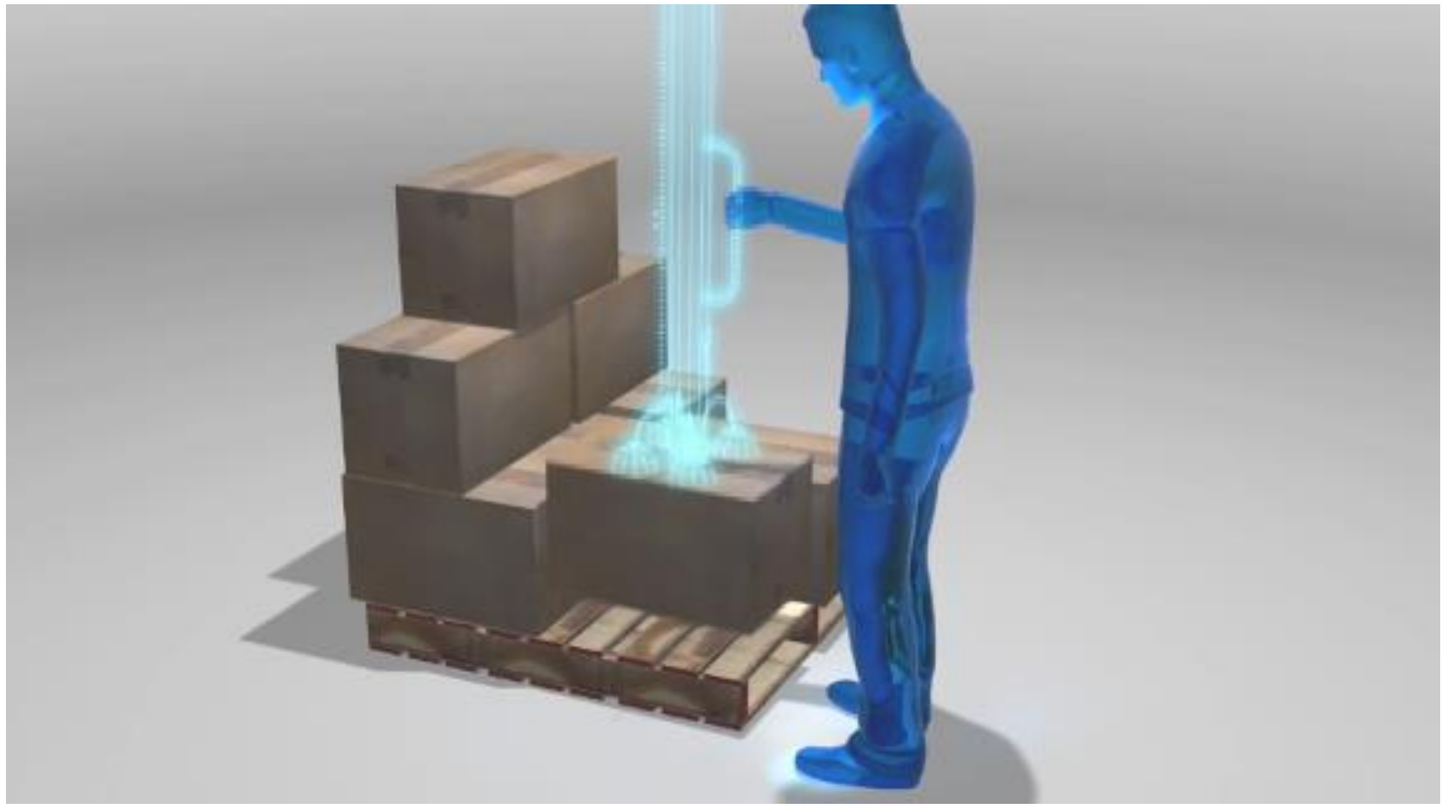
Effectiveness for *Controlling MSIs*

ENGINEERING CONTROLS – LIFT AIDS



Effectiveness for *Controlling MSIs*

ENGINEERING CONTROLS – LIFT TABLES

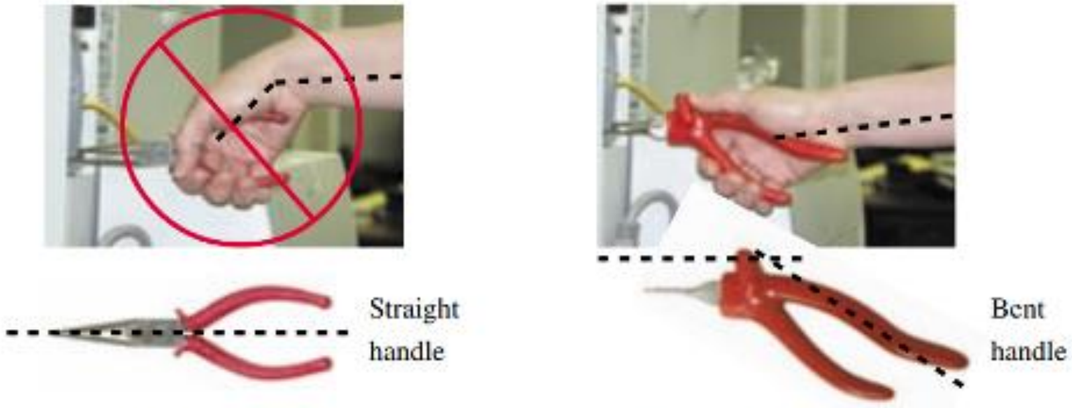


Effectiveness for *Controlling MSIs*

ENGINEERING CONTROLS Tool Design

- “Bend the tool, not the wrist”
- Tool selection in terms of handle shape is dependent on orientation of work

Tools with bent handles are better than those with straight handles when the force is applied horizontally (in the same direction as your straight forearm and wrist).



Bod y

Tools with straight handles are better than those with bent handles when the force is applied vertically.

Straight handle | Bent handle

Effectiveness for *Controlling MSIs*

ENGINEERING CONTROLSTool Design

- “Bend the tool, not the wrist”

HAGUE AND KHAN, 2010

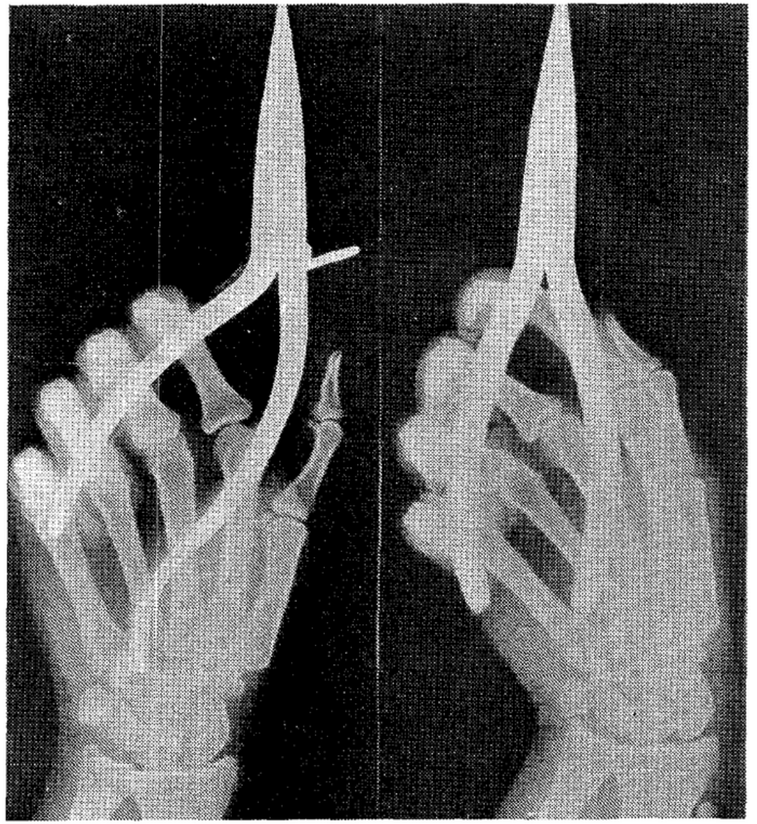


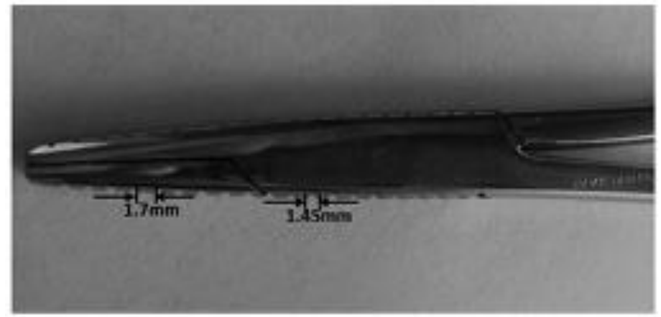
Figure 1⁴ — A poorly designed handtool may cause ulnar deviation of the wrist as indicated in the top view. The offset handle (bottom view) allows more normal alignment of the wrist reducing the lateral deviation forces acting at the carpal tunnel.

TICHAUER AND GAGE, 1977

Effectiveness for *Controlling MSIs*

ENGINEERING CONTROLS Suturing Tool Design

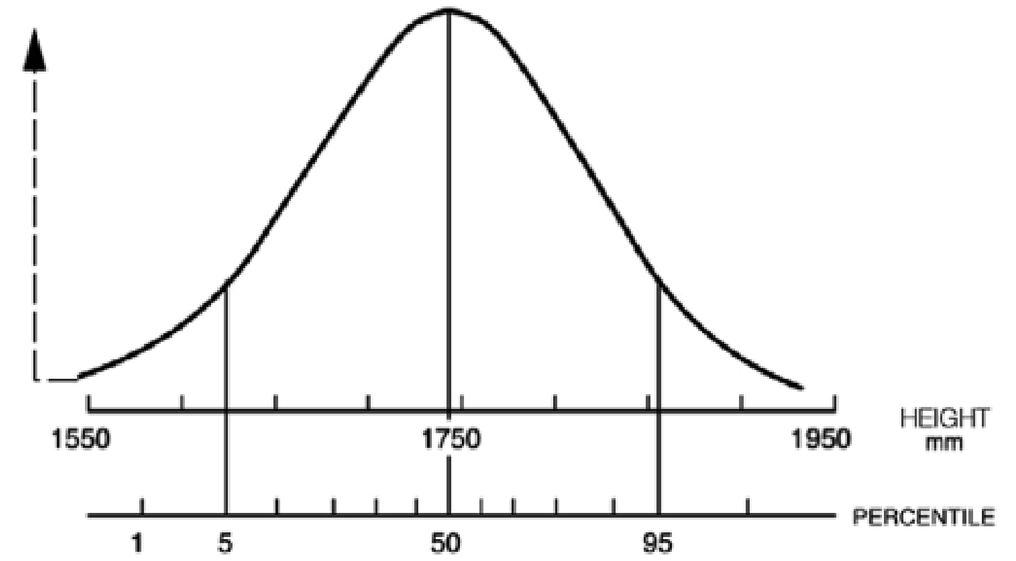
- “Bend the tool, not the wrist”
- “New grip design of needle holder reduced time to suture, led to better wrist posture, less difficulty, and less discomfort compared with traditional grip”



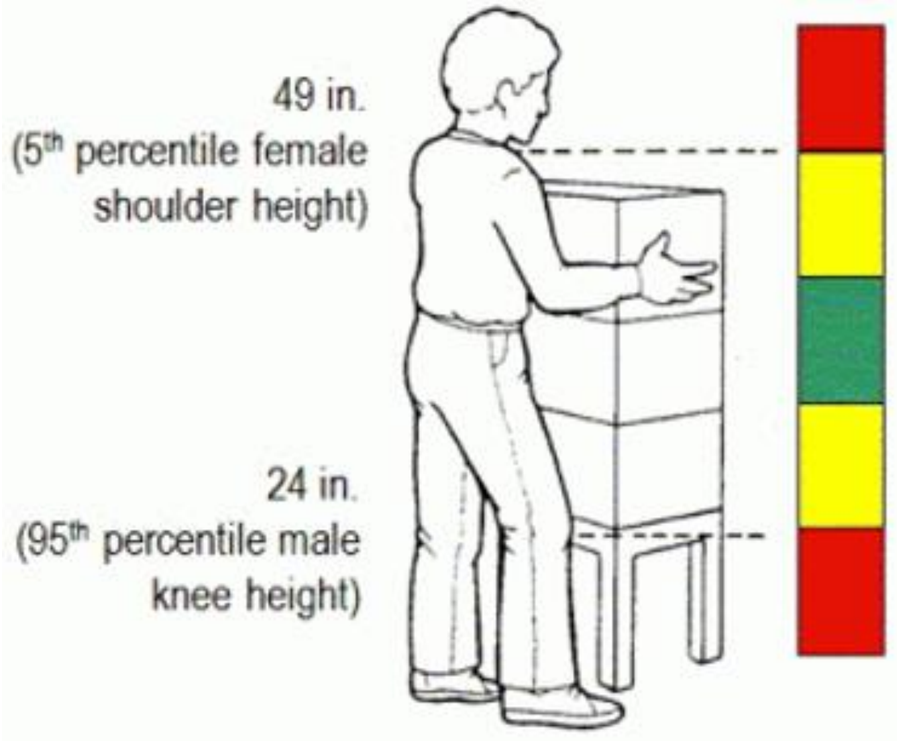
Abdelall et al., 2021

Effectiveness for *Controlling MSIs*

ANTHROPOMETRY AND DESIGN OPTIMAL LIFTING HEIGHT

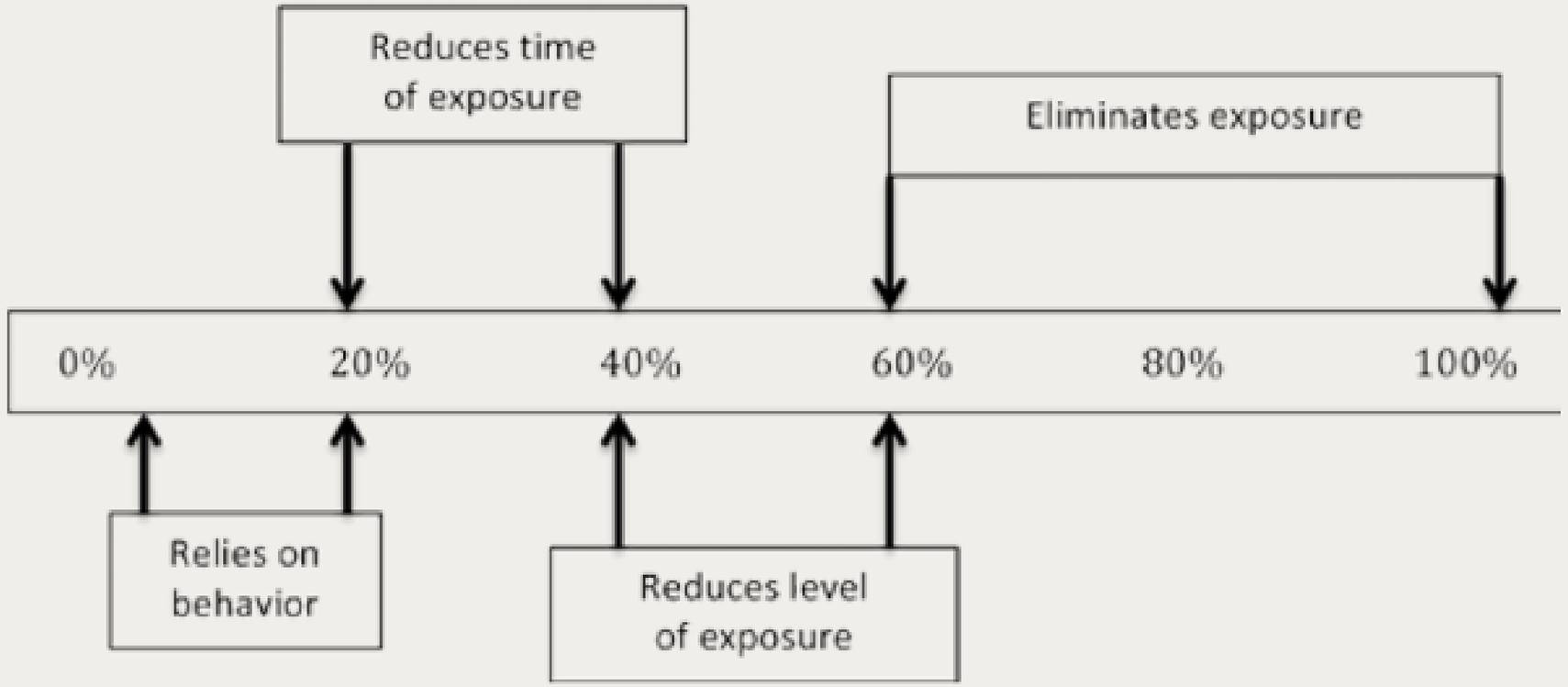


The curve obtained through approximation has a normal Gaussian distribution (the curve is symmetrical in comparison to the central value) and has a similar trend for all of the measurements of the human body found within sufficiently broad population groups. The data reported here refers to the adult population in the UK.

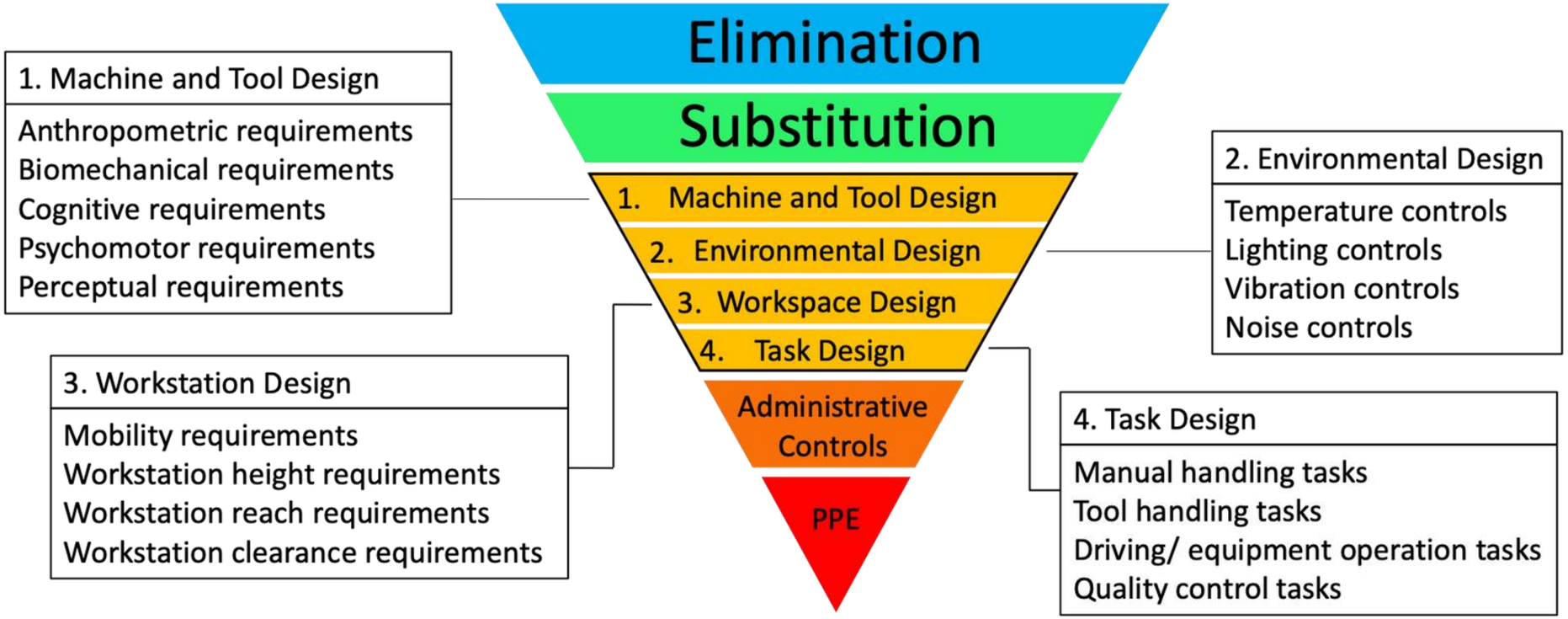


ERGOWEB, MACLEOD, 2013

Relationship of Safety Intervention Effectiveness



Hierarchy of Controls
with Engineering Controls



DEROUIN, 2013

Preventing Musculoskeletal Injuries

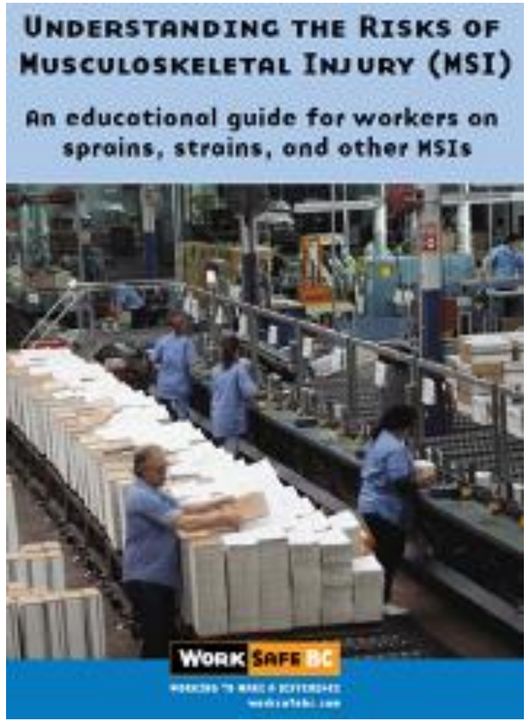
FILL THE GAPS FOR MSI RISK CONTROL

MIS
MAKE IT SAFE

Preventing Musculoskeletal Injuries

6. Resources and Tools available for MSIP

WSBC Resources for Preventing MSIs



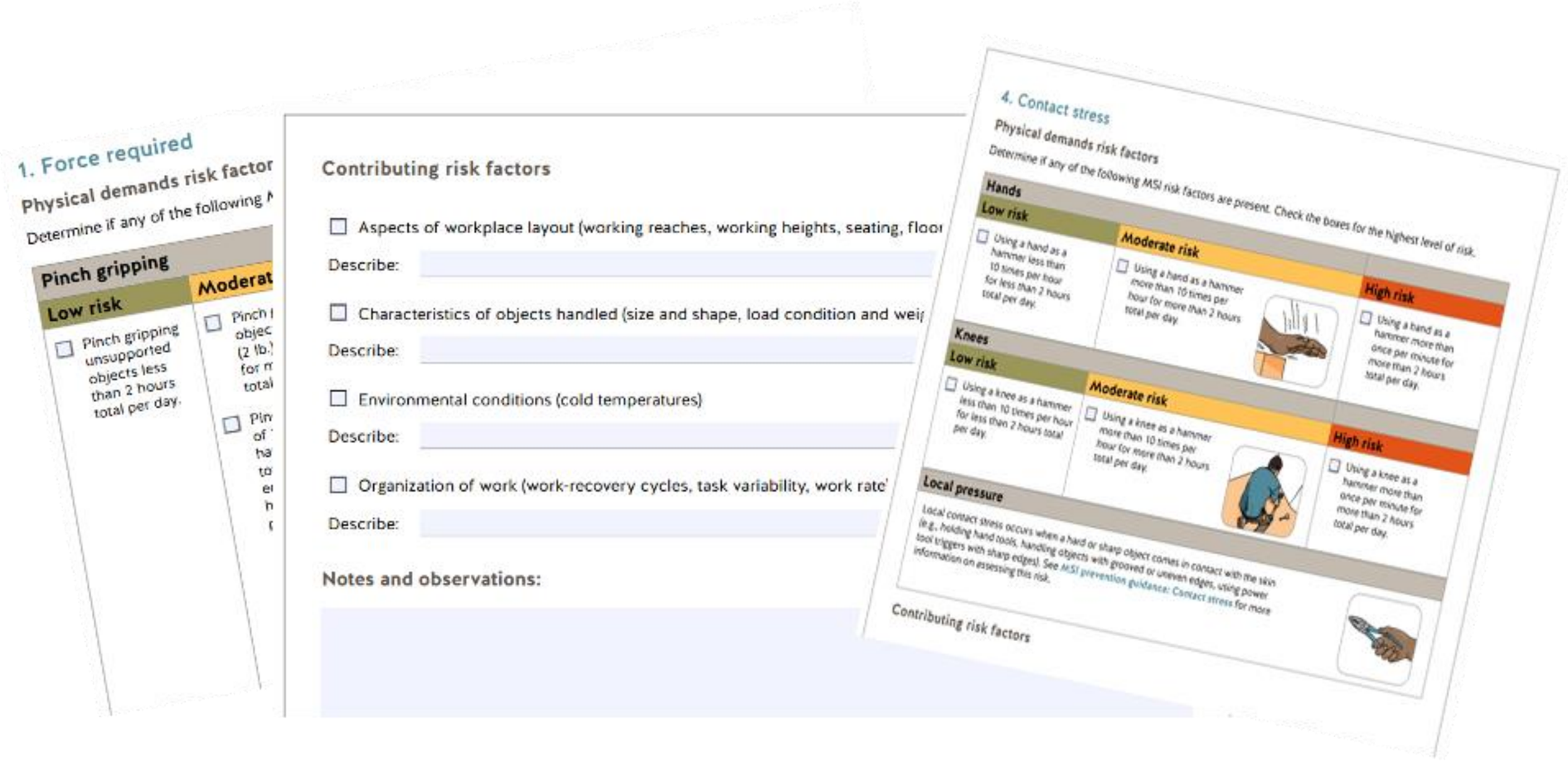
ERGONOMICS ENEWS

WWW.WORKSAFEBC.COM/ERGONOMICS

WSBC Resources for Preventing MSIs

MSI PREVENTION GUIDANCE INFORMATION SHEETS

WSBC Worksheet for MSI Risk Assessment



WSBC Tools for MSI Risk Assessment

WORK SAFE BC

Lift/Lower Calculator

Step 1 › How much is the actual weight you are lifting or lowering?

Actual Weight ◉ lb. ○ kg

Step 2 › Where are your hands when they are in the most extreme position (e.g., highest, lowest, and/or furthest away from you) during the lift or lower?

Step 3 › Do you twist your body more than 45 degrees during the lift or lower?

◉ Yes ○ No

Step 4 › How many lifts or lowers per minute?

1 lift every 5+ min

Step 5 › For how many hours per day?

1 hr or less

Step 6 › Click "Calculate" to view the results:

Calculate

Effective for Controlling MSIs

UNDERSTANDING DEMAND VS. CAPACITY MMH TOOLS

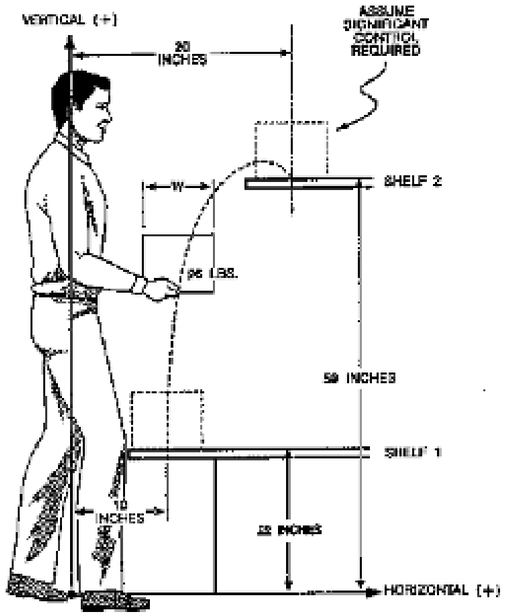
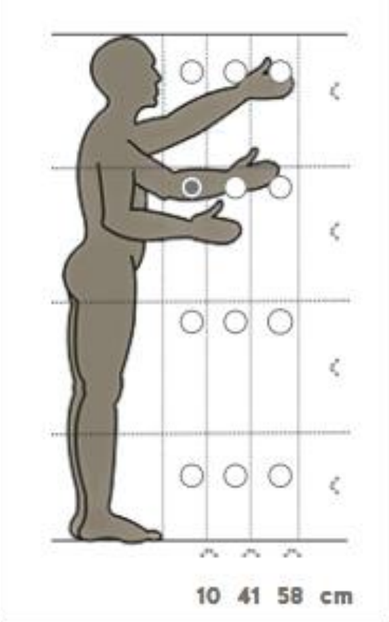
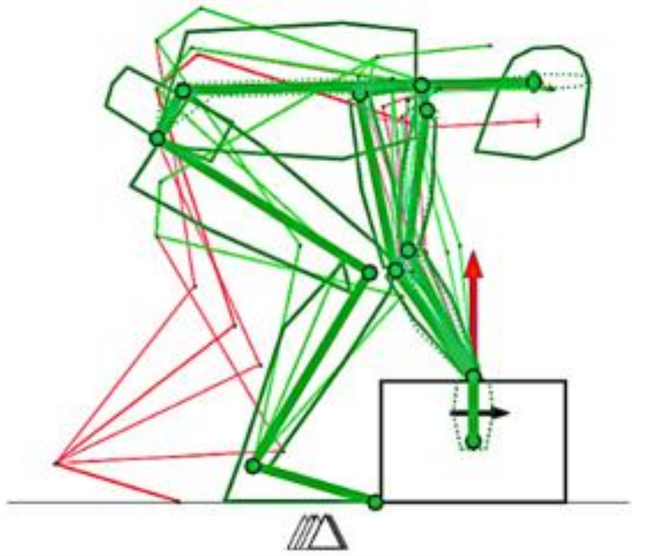


Figure 13 Package Inspection, Example 4

NIOSH Lifting Equation, 1994

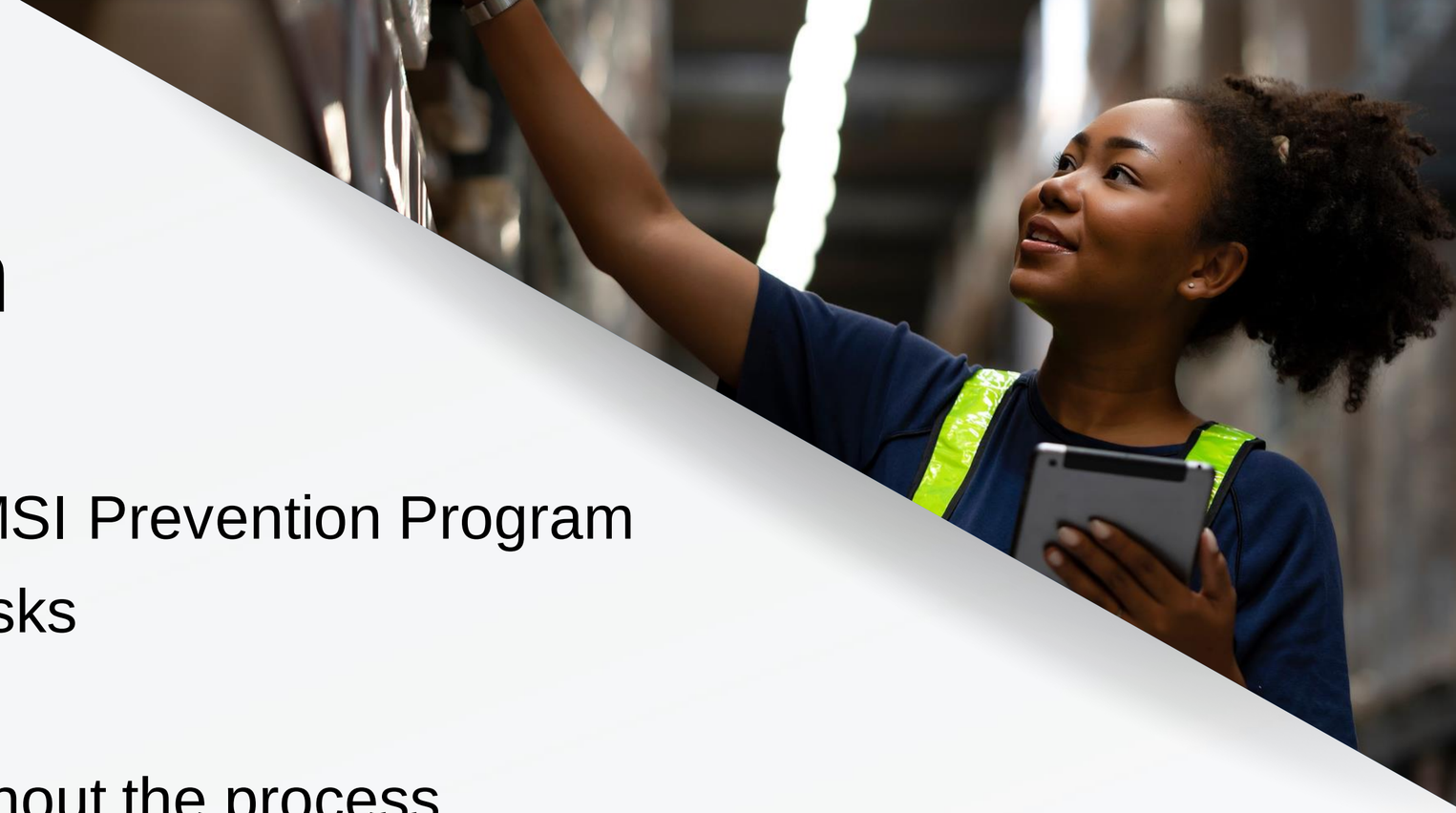


WSBC Lift/Lower Calculator



Work(s) Ergo

Musculoskeletal Injury Prevention



SUMMARY

- Build a foundation for your MSI Prevention Program
- Assess and Manage MSI Risks
- Control the MSI risk factors
- Consult with workers throughout the process

AARON DEROUIN
Safety Advisor Specialist - Ergonomics
Manufacturing Safety Alliance of BC
a.derouin@safetyalliance.ca

GEOFF WRIGHT
Ergonomist, Prevention Services Division
WorkSafeBC
geoff.wright@worksafebc.com

MIS
MAKE IT SAFE