



Introduction to Ergonomics

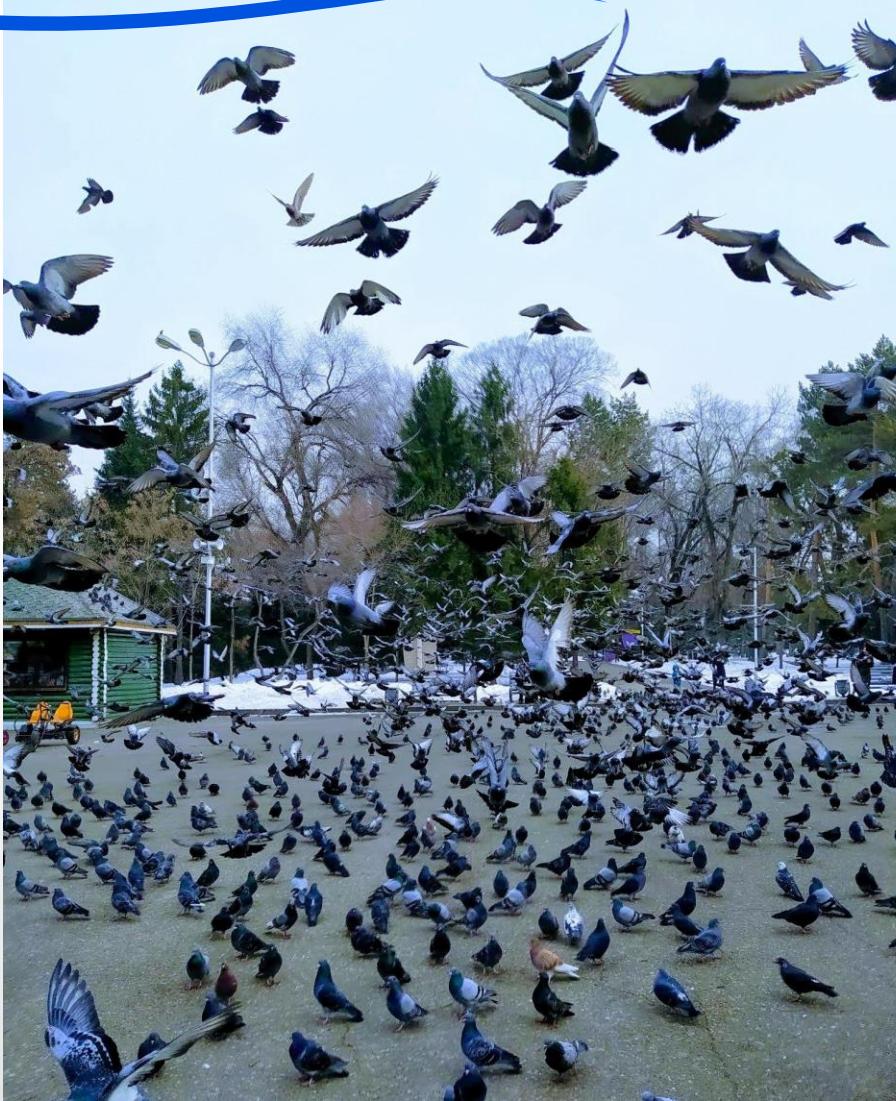
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Park of 28 Panfilov Guardsmen, Almaty, Kazakhstan, January 13, 2020

Special thanks to Valeriya Nikiforova for sharing her pics



Naryn, Kyrgyzstan, 1:03pm, February 5, 2023



Lessons learnt last time



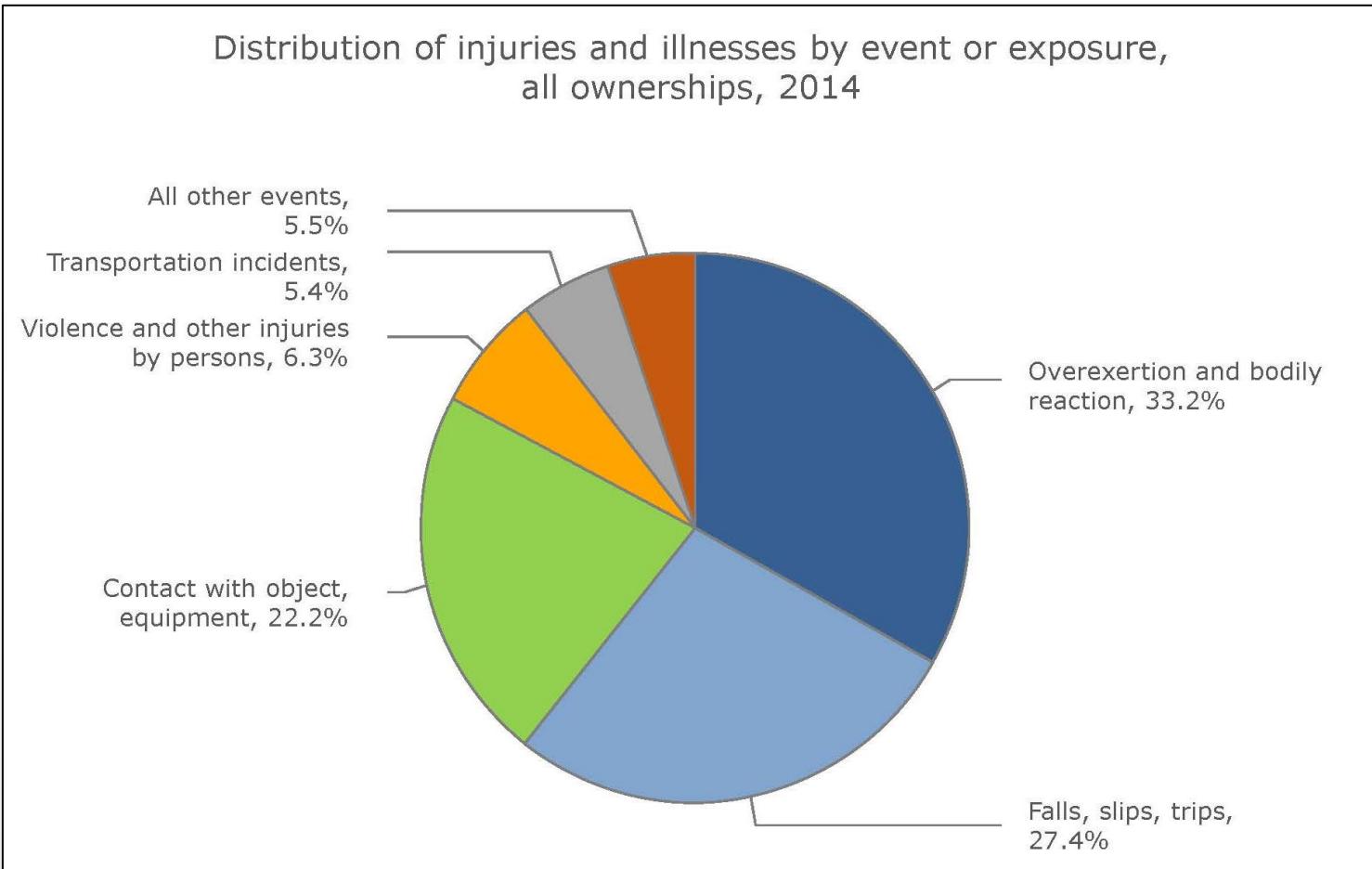
- Tutorial: Presentation of the Course project's outline
(maximum 3 min)
- Why is the (new) standard needed?
- What does ISO 45001 introduce that we haven't had before?
- 45001: An implementation guide
- Arduino-based Management Alarm Systems

What we gonna discuss today?



- Introduction
- Common work-related musculoskeletal disorders (MSDs)
- Risk factors associated with work-related MSDs
- Ergonomic control methods for eliminating/reducing work-related MSDs
- Employer/Employee requirements
- 5 steps to perform ergonomic workspace with PC

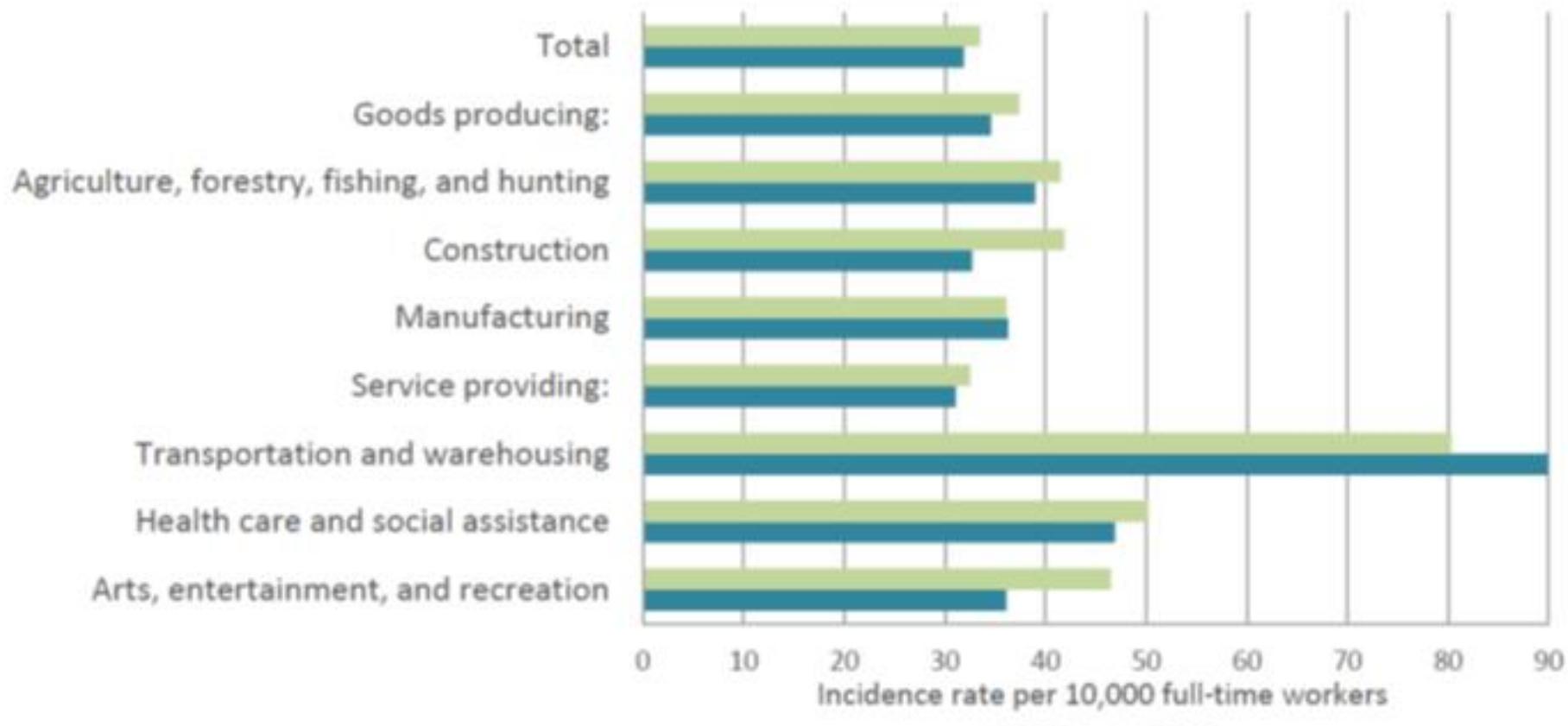
Introduction



This chart shows how MSDs compare to other hazards based on percentage of injuries and illnesses using statistics from the Bureau of Labor Statistics, FY2014

Introduction

Musculoskeletal disorder incidence rates for selected private sector industries, 2013-14



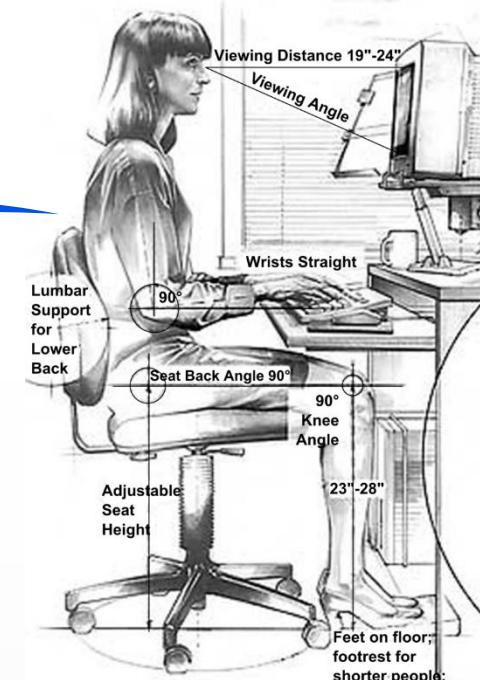
Source: U.S. Bureau of Labor Statistics

■ 2013 ■ 2014

Introduction

- Ergonomics

- ... is the scientific discipline concerned with understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, methods, and data to design in order to optimize human well-being and overall system performance



Introduction



- Ergonomics means

“fitting the job to the worker,”

including:

- Workstations
- Tools
- Equipment

Ergo means Work

Nomos means Rules

(Greek language)

Introduction

- Why is ergonomics important?
 - Overexertion is a leading cause of injuries
 - Most costly
 - Recurring/Persistent pain may develop in future
 - Bodily reaction is another leading cause of injuries in workplace
 - Repetitive motion also within top 10 most common workplace injuries



Common work-related MSDs

- Musculoskeletal Disorders (MSDs)

- Affect the muscles, nerves, blood vessels, ligaments, and tendons

- Symptoms

- Discomfort
 - Pain
 - Numbness
 - Loss of motion/flexibility
 - Spasticity
 - Stiff joints



- Burning
 - Swelling
 - Tingling
 - Inflammation
 - Throbbing
 - Paralysis

Common work-related MSDs (cont.)

- Common MSD disorders:

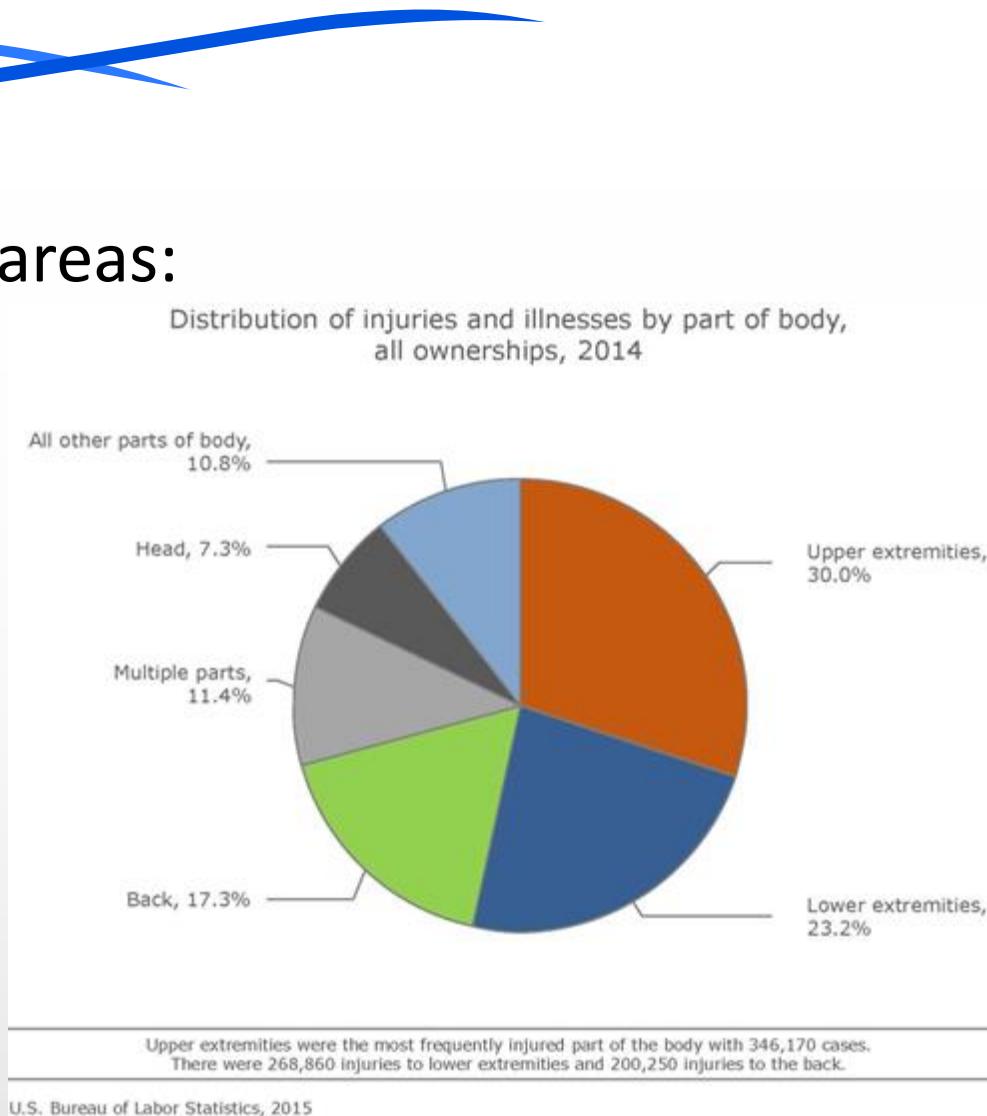
- Carpal tunnel syndrome
- Tennis elbow
- Bursitis
- Ischemia
- De Quervain syndrome
- Sciatica
- Spinal disc herniation
- Neck strain/disability
- Tendinitis
- Rotator cuff
- Neuritis
- Raynaud syndrome
- Trigger finger
- Thoracic outlet syndrome
- Back strain/disability
- ...



Common work-related MSDs (cont.)

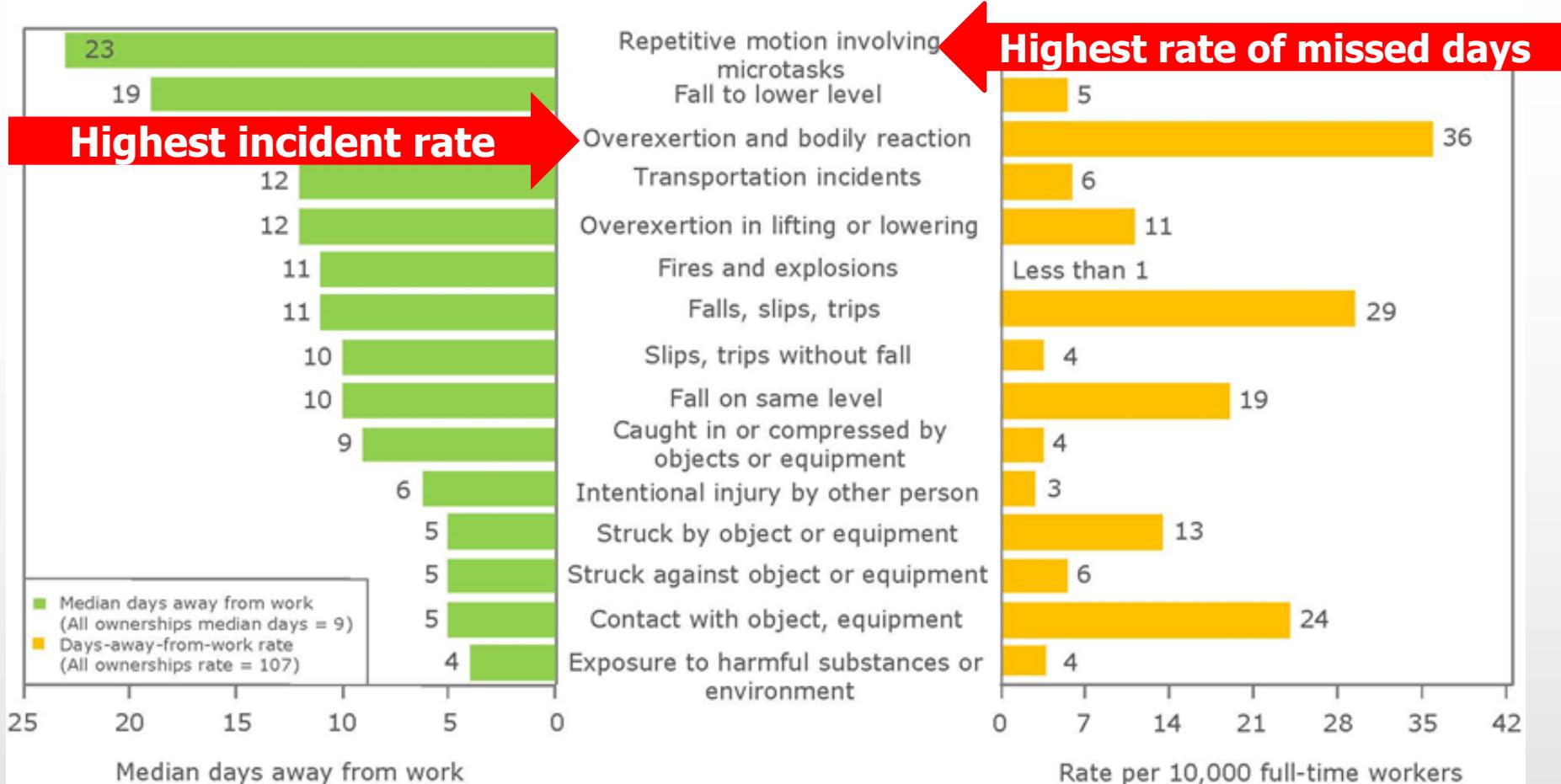
- Most commonly affected areas:

- Back
- Arms, Elbows, and Shoulders
- Neck
- Hands, Wrists, and Fingers
- Knees, Ankles, and Feet



Common work-related MSDs (cont.)

Median days away from work and incidence rate due to injuries and illnesses by event or exposure, all ownerships, 2014



Risk Factors Associated with MSDs

- Risk factors of MSD injuries:
 - Dependent upon:
 - Work positions and postures
 - How often task is performed
 - Level of required effort and duration of task



Risk Factors Associated with MSDs (cont.)

- Examples of risk factors include:
 - Exerting excessive force
 - Lifting heavy objects/people
 - Pushing or pulling heavy loads
 - Manual pouring materials
 - Maintaining control of equipment or tools
 - Performing same/similar tasks repetitively



Risk Factors Associated with MSDs (cont.)

- Working in awkward postures or same postures for long periods
 - Prolonged/repetitive reaching above shoulder height
 - Kneeling
 - Squatting
 - Leaning over a counter/bending
 - Using a knife with wrists bent
 - Twisting the torso while lifting
- Localized pressure into the body part
 - Pressing the body/part of the body against hard or sharp edges
 - Using the hand as a hammer



A 5MB hard drive being shipped by IBM, 1956

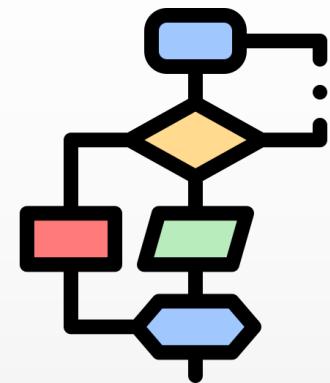
Risk Factors Associated with MSDs (cont.)

- Cold temperatures (in combination with other risk factors)
- Vibration
 - Whole body
 - Hand-arm
- Combined exposure to several risk factors



Ergonomic Control Methods

- Methods of protecting against MSDs:
 - Establish ergonomics program
 - Training
 - Feedback from all levels
 - Conduct job hazard analysis
 - Early recognition and reporting of potential MSDs

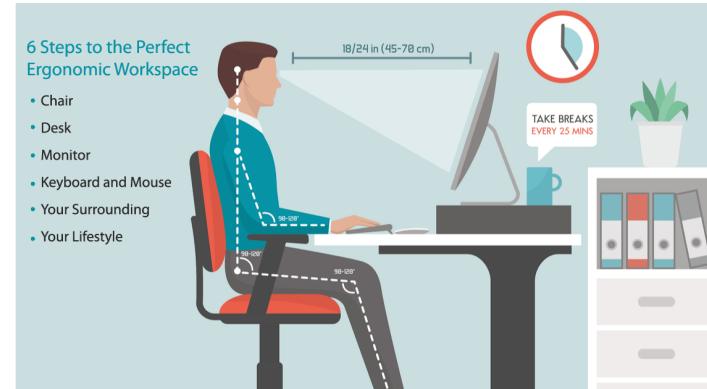


Ergonomic Control Methods (cont.)

- Examples of engineering controls
 - Workstation design and setup
 - Ergonomically designed tools
 - Ergonomically designed equipment
 - Load weight reduction



5 MB hard drive, IBM, 1956



Micro SD memory card

Ergonomic Control Methods (cont.)

- Examples of proper work practices:
 - Proper lifting techniques
 - Team lift heavy/bulky/awkward loads
 - Stretch
 - Work rotation
 - Task variety
 - Increase rest breaks



Ergonomic Control Methods (cont.)

https://www.youtube.com/watch?v=Z_pdZ1LW5iw

- Exoskeletons Will Make Work Weightless



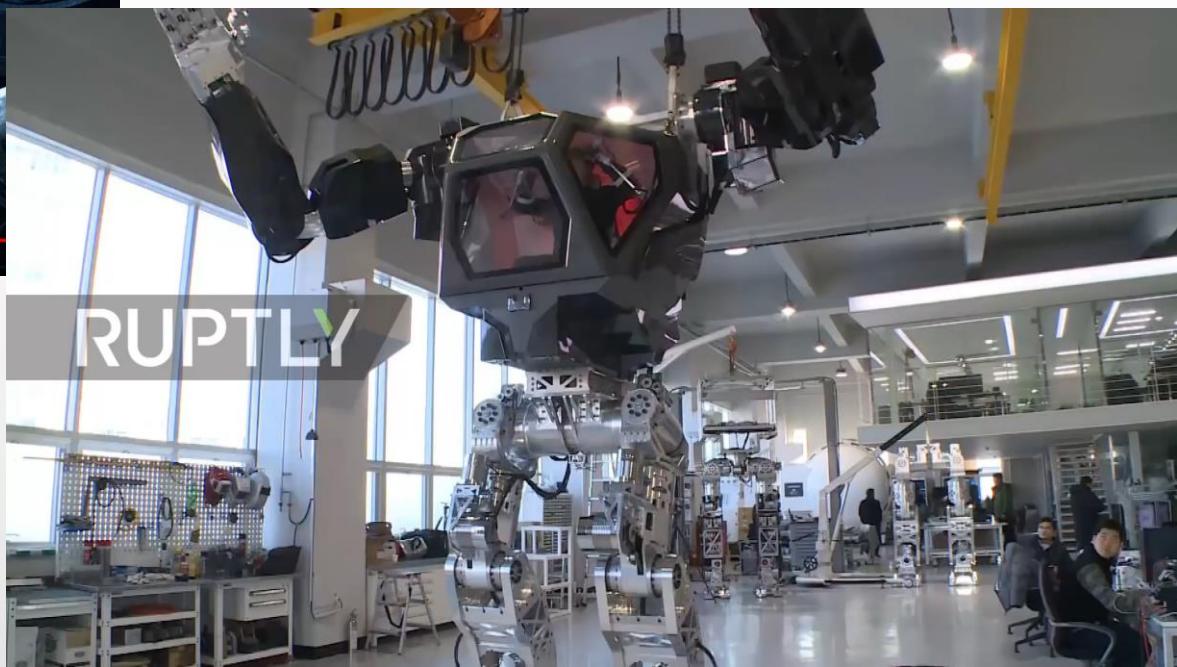
Ergonomic Control Methods (cont.)

- Exoskeletons: Can we do something similar to movie Avatar? :)



<https://www.youtube.com/watch?v=wBJ0gGJXDAs>

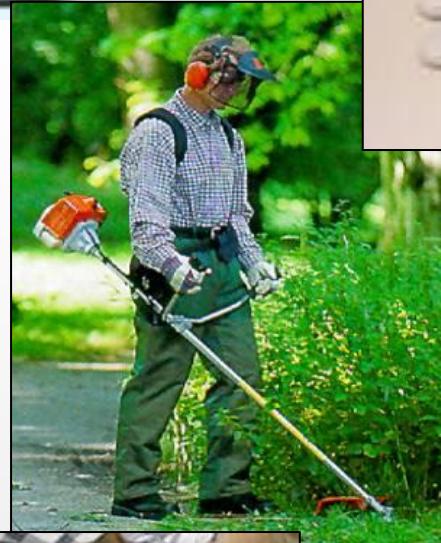
In 2016, South Korea made world's first giant manned robot



<https://www.youtube.com/watch?v=7rgFtkMiXms>

Ergonomic Control Methods (cont.)

- Examples of PPE:
 - Protective glasses
 - Gripping gloves
 - Knee pads
 - Vibration gloves
 - Thermal gloves
 - Lifting straps
 - Shoulder harness
 - Lifting braces



Ergonomic Control Methods (cont.)

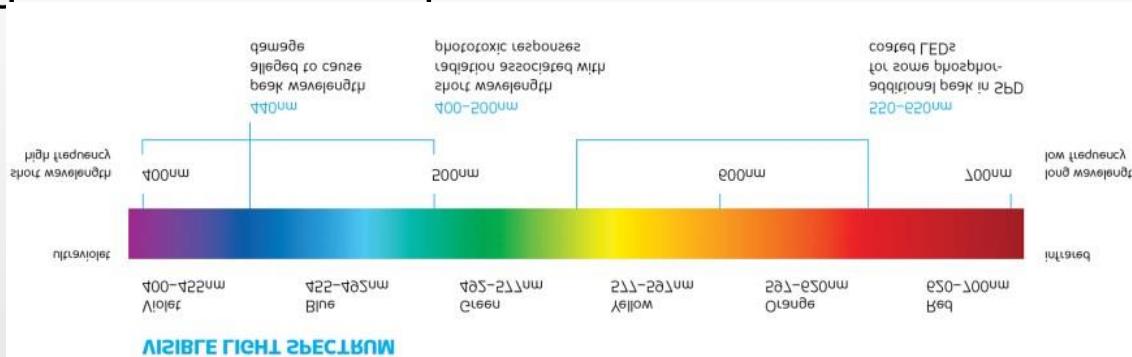


What is blue light (high-energy visible light)?



Ergonomic Control Methods (cont.)

- What is blue light (high-energy visible light)?
- High-energy visible light (HEV light) is high-frequency, high-energy light in the violet/blue band from 400 to 450 nm in the visible spectrum, which has a number of biological effects, including those on the eye
 - Harvard Health Publishing additionally asserts that exposure to blue light (especially blue LED light, but also broad-spectrum blue light), at night, has a stronger negative effect on sleep

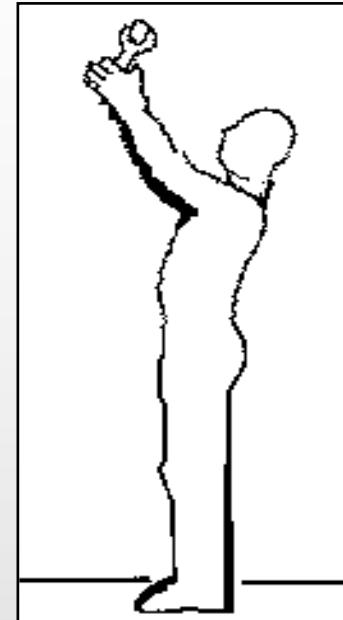


https://en.wikipedia.org/wiki/Biological_effects_of_high-energy_visible_light

https://www.architectmagazine.com/technology/lighting/blue-light-hazard-and-leds-fact-or-fiction_o

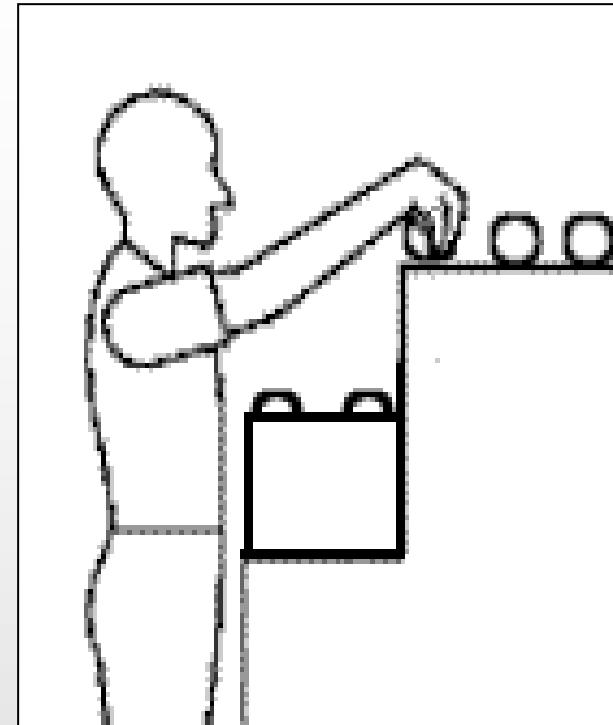
Ergonomic Control Methods (cont.)

- Physical ergonomic hazards and solutions:
 - Reaching above the head/shoulders - hazards
 - Working with the hands above head for more than 2 hours per day



Ergonomic Control Methods (cont.)

- Working with the elbows above shoulders for more than 2 hours per day



Ergonomic Control Methods (cont.)

- Reaching above the head/shoulders - **solutions**

- Keep items within close reach
- Elevate work areas



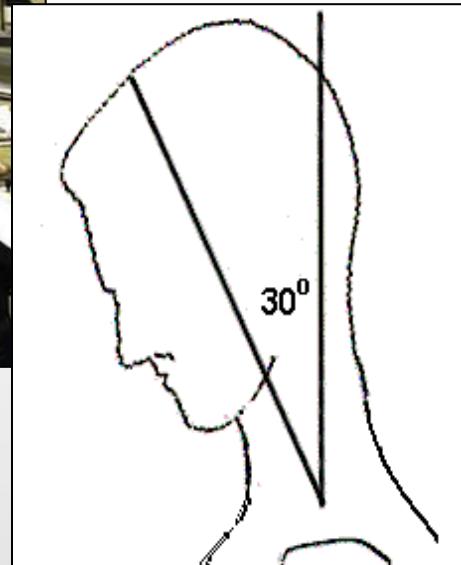
Ergonomic Control Methods (cont.)

- Reaching above the head/shoulders - **solutions**
 - Remove obstacles
 - Utilize equipment to raise and lower items or move items closer to worker



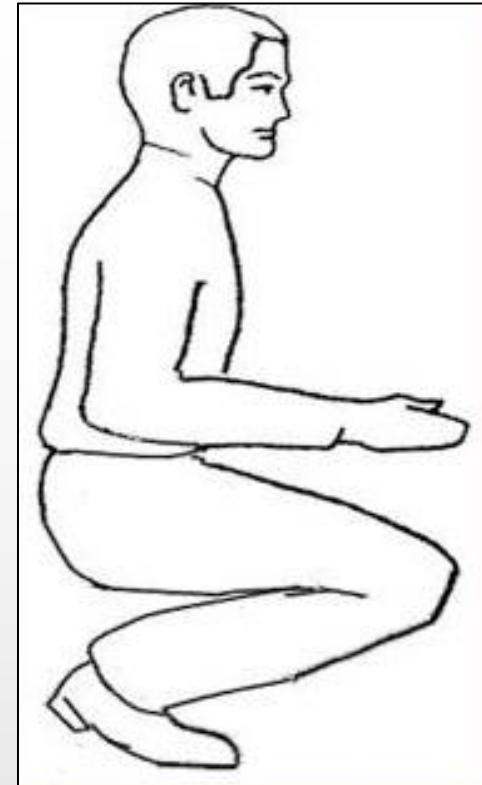
Ergonomic Control Methods (cont.)

- Awkward body postures - **hazards**
 - ° Working with the neck or back bent forward more than 30° for more than 2 hours per day



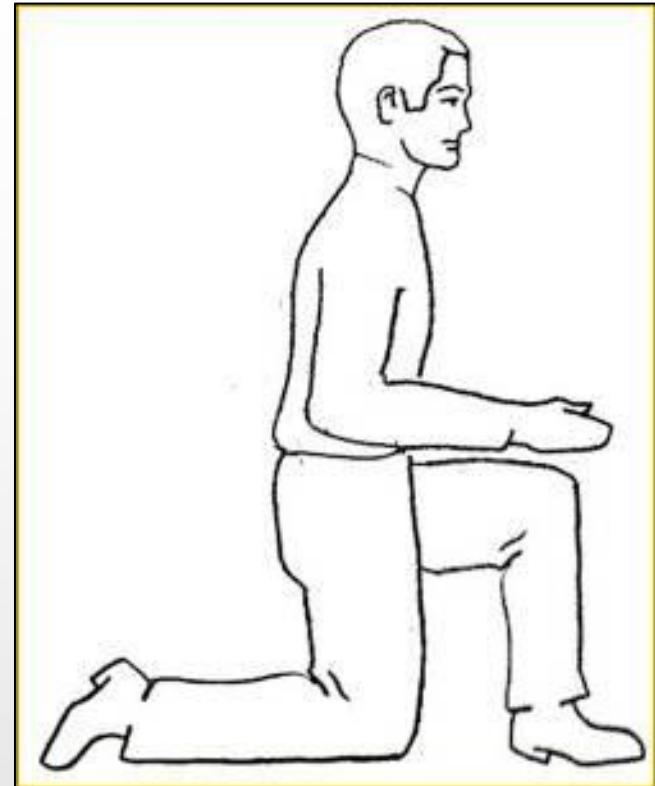
Ergonomic Control Methods (cont.)

- Squatting for more than 2 hours per day



Ergonomic Control Methods (cont.)

- ° Kneeling for more than 2 hours per day



Ergonomic Control Methods (cont.)

- Awkward body postures - **solutions**
 - Raise and/or tilt the work for better access
 - Use a stool for ground-level work



Ergonomic Control Methods (cont.)

- Awkward body postures - **solutions**
 - Use tools with longer handles
 - Alternate between bending, kneeling, sitting, and squatting



Ergonomic Control Methods (cont.)



- Awkward grips - **hazards**
 - Gripping 4.5 or more kg or force for 2 or more hours per day

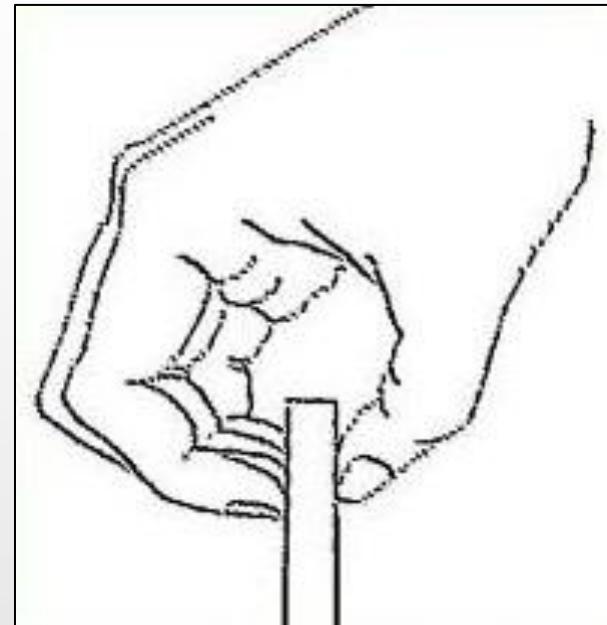


Ergonomic Control Methods (cont.)



- Awkward grips - **hazards**

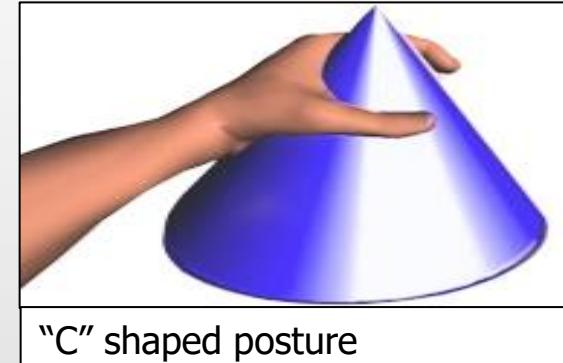
- Pinching 1 or more kg of weight or 2 or more kg of force for 2 or more hours per day



Ergonomic Control Methods (cont.)

- Awkward grips - **solutions**

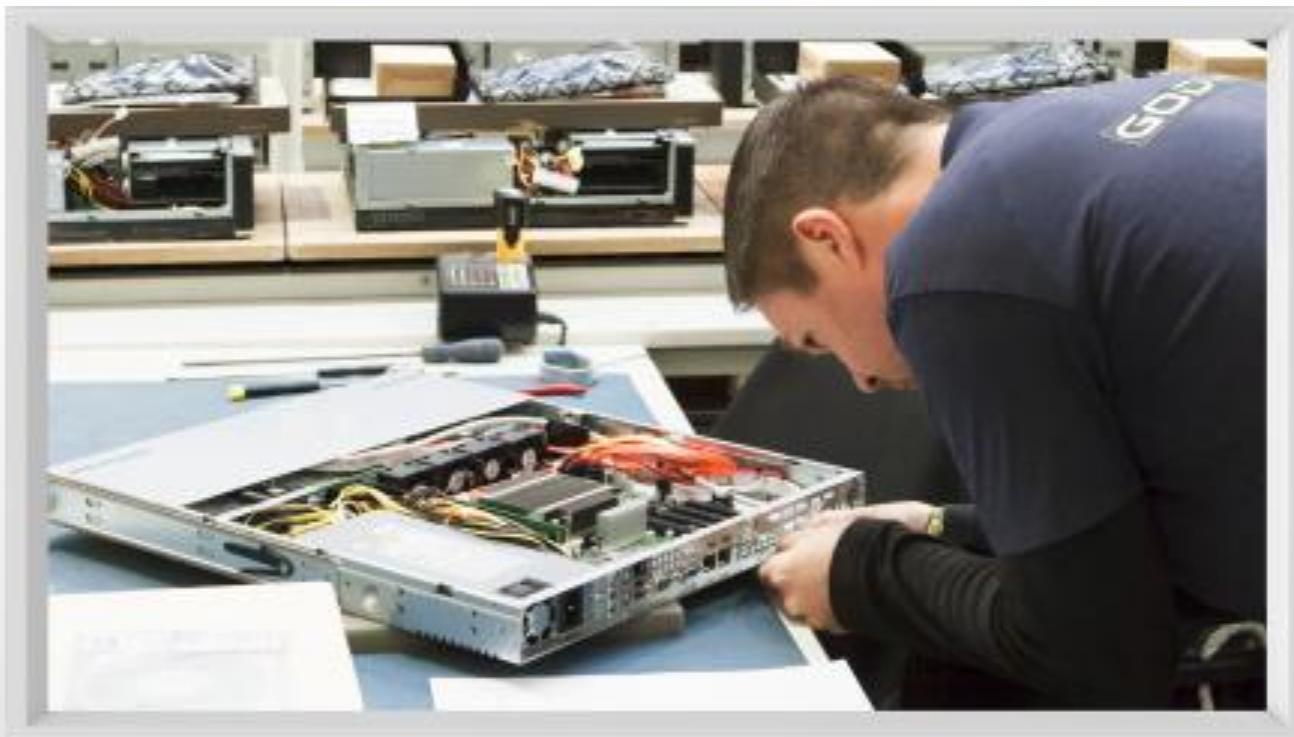
- Design work layout to reduce hand-carrying
- Reduce number of items carried at one time
- Use non-pinch grip postures
- Use ergonomically designed tools/aids
- Use job/task rotation



Ergonomic Control Methods (cont.)



- Repetitive motions - **hazards**
 - Repeating same motion for more than two hours per day with hands, wrists, elbows, shoulders, or neck



Ergonomic Control Methods (cont.)

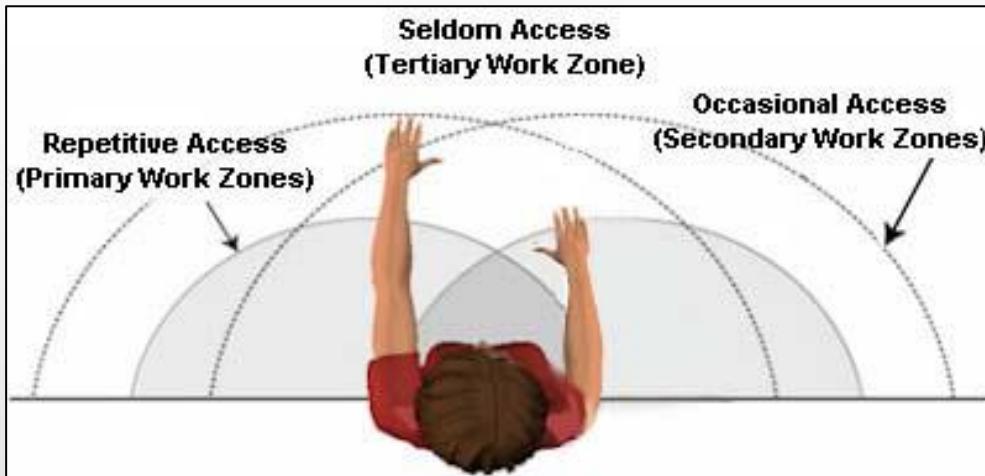
- Repetitive motions - **hazards**
 - Intense keying for more than 4 hours per day



Ergonomic Control Methods (cont.)

- Repetitive motions - **solutions**

- Arrange work to avoid unnecessary motions
- Let power tools and machinery do the work
- Spread repetitive work out during the day
- Take stretch pauses
- Rotate task with co-workers if possible
- Change hands or motions frequently



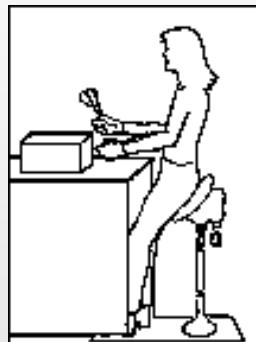
Ergonomic Control Methods (cont.)

- Localized pressure on body part - **hazards**
 - Pressing the body/part of the body against hard or sharp edges
 - Standing/kneeling for prolonged periods on hard surfaces
 - Using tools with hard handle surfaces or short handles



Ergonomic Control Methods (cont.)

- Localized pressure on body part - **solutions**
 - Use tools with longer handles
 - Use tools with padded grips
 - Alternate between bending, kneeling, sitting, and squatting; use sit/stand stools or tables



Ergonomic Control Methods (cont.)



- Environmental ergonomic **hazards**:
 - Amplify/increase risk of MSDs
 - Examples
 - Hot weather
 - Cold weather – affects worker coordination and dexterity
 - High-temperature indoor (steam rooms, attics)
 - Cold-temperature indoor (walk-in freezers, cold process rooms)
 - Low visibility



<https://www.pinterest.com>

Employer/Employee Requirements

- General duty clause

- 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

- Shall comply with occupational safety and health standards

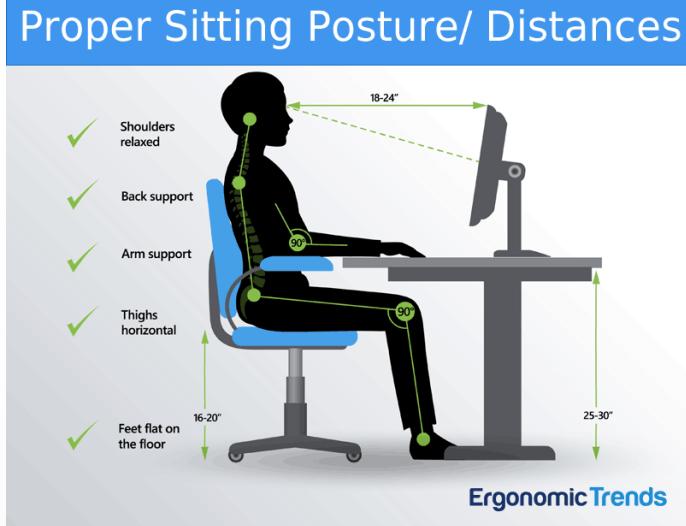
- Each Employee:

- Shall comply with occupational safety and health standards and all rules, regulations, and orders which are applicable to his own actions and conduct



5 steps to perform ergonomic workspace with PC

- Step 1 – Choose the right chair
- Step 2 – Adjust your desk height
- Step 3 – Position your monitor properly
- Step 4 – Pick the right keyboard and mouse
- Step 5 – Organize your workstation into zones



5 steps to perform ergonomic workspace with PC

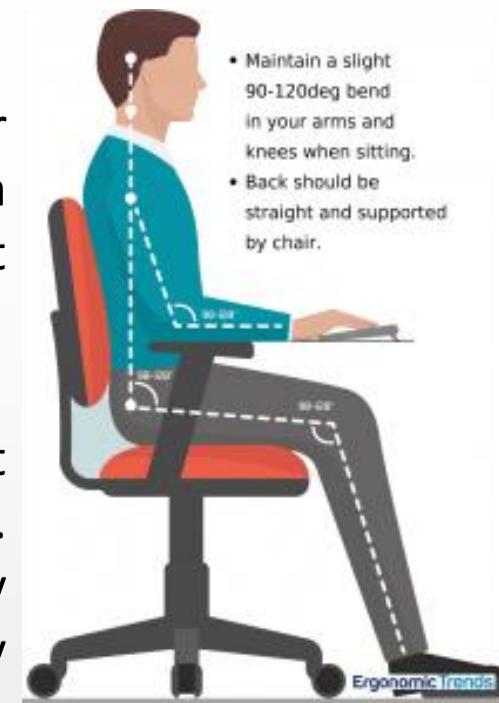
- Step 1 – Choose the right chair

- Height:

- We should be able to sit with our feet flat on the floor and our thighs roughly parallel to the floor. If we need a taller chair in order to reach a too-tall desk, use a footrest to get the right leg angle.

- Backrest recline and tilt:

- To reduce stress in our spine, an office chair that reclines and tilts with tension control are critical. Research has shown that a reclined seat significantly reduces the pressure on our back and is particularly beneficial for people with back pain. Look for chairs that can recline at least 135 degrees back with synchronous tilt.



5 steps to perform ergonomic workspace with PC

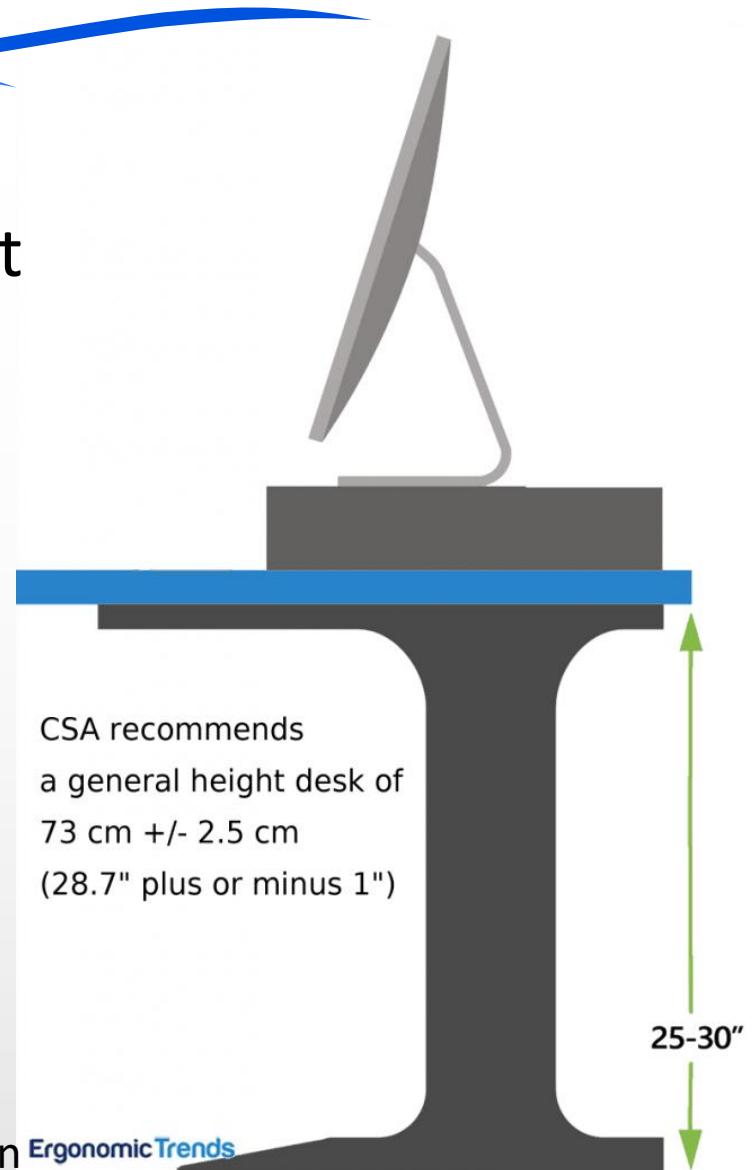


- Lumbar support:
 - The shape of the backrest should have a natural curve to support the lower back. Think Birkenstocks for the back. Consider using a lumbar support pillow if your chair lacks proper lumbar support.
- Seat depth:
 - For fixed seats, the ideal depth is 16.5", and 14-18.5" for adjustable seats
- Arm rests:
 - Look for armrests that are not just height adjustable but can pivot inwards to support the entire length of the forearm when performing certain tasks such as keyboarding
- Material:
 - Try to find a comfortable amount of cushioning: your chair should feel supportive without being overly hard. Look for breathable or mesh fabric.

5 steps to perform ergonomic workspace with PC

- Step 2 – Adjust your desk height

Ergonomic Desks:



5 steps to perform ergonomic workspace with PC

- Step 3 – Position your monitor properly



DISTANT

Place your monitor about 20 inches in front of you or at arm's length

ANGLE

Your monitor should be placed at an angle of about 10 to 20 degrees

HEIGHT

The top line of your screen should be at or below eye level.

5 steps to perform ergonomic workspace with PC

- Step 3 – Position your monitor properly

- Lighting:

- Good lighting ergonomics in the office involve many things, from sufficient lighting (300-500 lux), elimination of shadows and dark spots in the room, to removing glare and picking the right color temperature based on the type of work we do

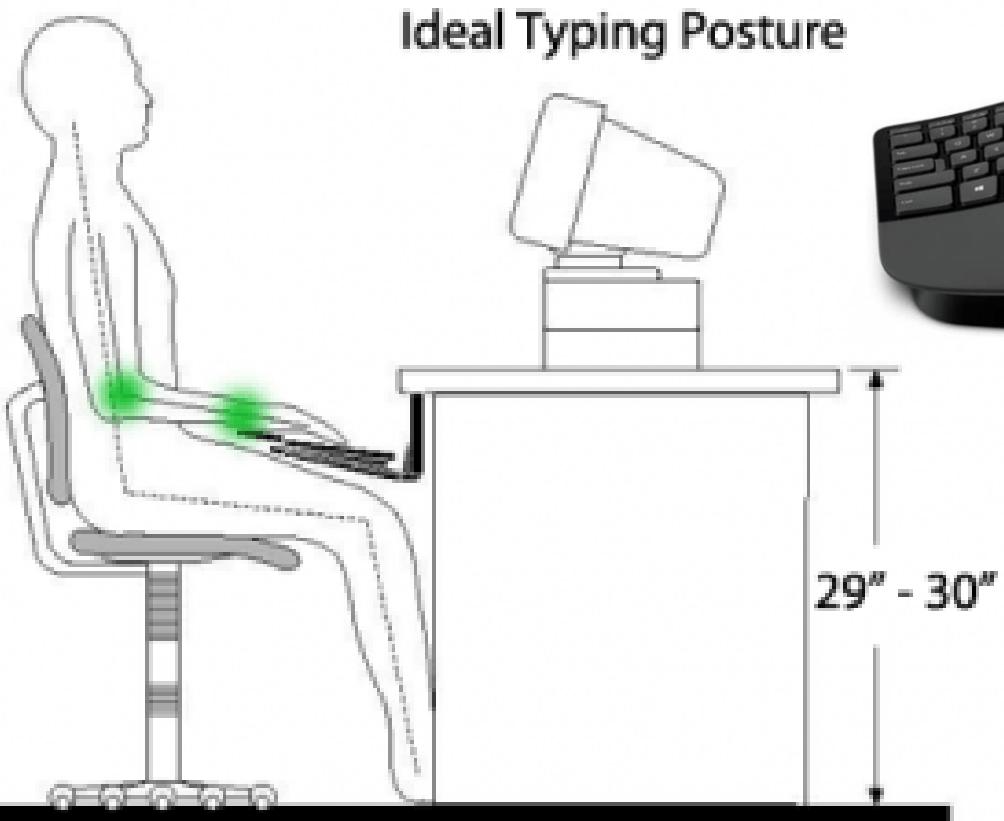
- Computer Glasses:

- Please use computer glasses. Blue light emitted from all the various electronic devices with a screen has been shown to cause eye fatigue, macular degeneration, and even blindness.



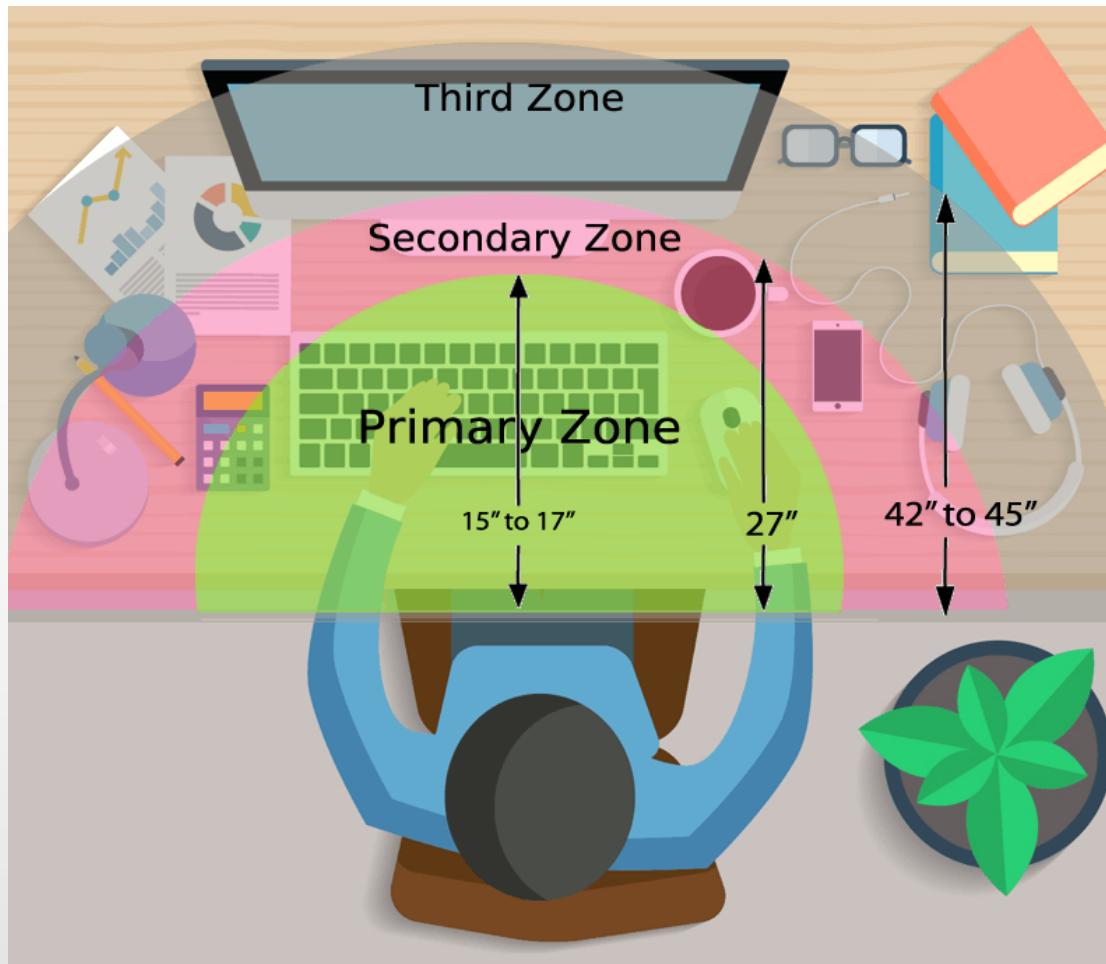
5 steps to perform ergonomic workspace with PC

- Step 4 – Pick the right keyboard and mouse



5 steps to perform ergonomic workspace with PC

- Step 5 – Organize your workstation into zones



5 steps to perform ergonomic workspace with PC

- Step 6 – ... ?



Do you have any
questions or
comments?





Thank you
for your attention !



In this presentation:

- Some icons were downloaded from flaticon.com and iconscout.com