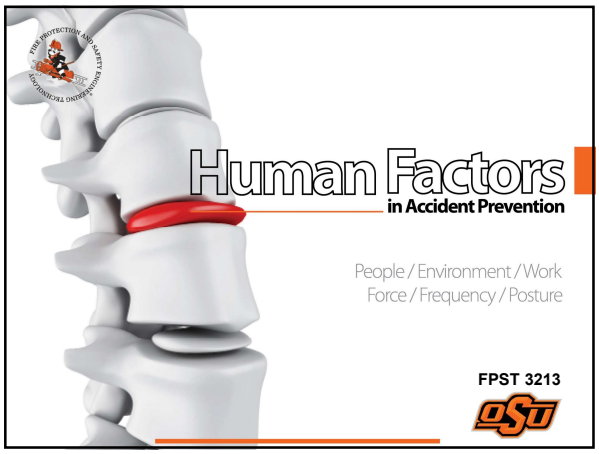
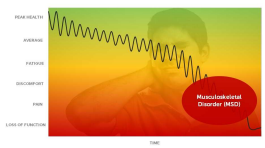


Musculoskeletal Disorders and Cumulative Trauma

Part 2

Understanding MSD's

Fatigue vs. Recovery Curve



- An injury or disorder to the human body's musculoskeletal (or "movement") system
- Muscles, tendons, ligaments, nerves, soft tissue, bones, and blood vessels.

Micro-trauma

↓

Muscle imbalance

FPST 3213 3

Back Disorders

FPST 3213 4

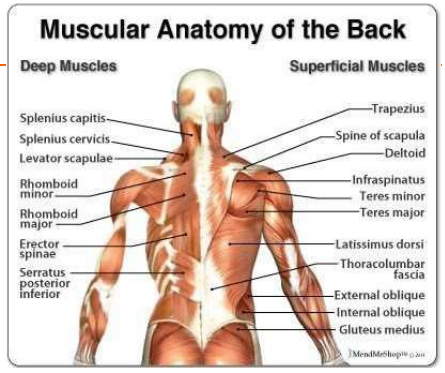
The Back

FPST 3213 5

The Back

FPST 3213 6

Muscular Anatomy of the Back



FPST 3213 7

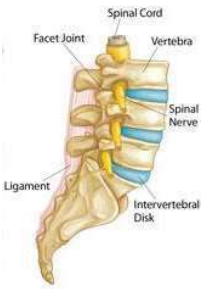
The Spine

- Cervical Spine –
  - Seven vertebrae
  - From base of the skull to the upper Chest
- Thoracic Spine
  - 12 vertebrae
  - From upper chest to middle back
  - Connected to rib cage
- Lumbar Spine
  - Five large vertebrae
  - Carry most of the weight

FPST 3213 8

Spinal Cord

- Continues as a bundle of nerve roots called the cauda equine



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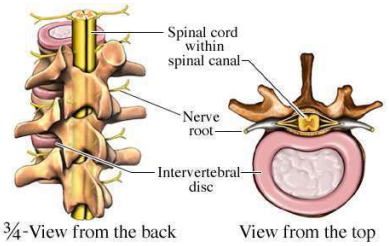
Spinal Cord and Nerves



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Intervertebral Disks

- Made up of:
  - Nucleus pulposus
    - Jelly-like center of the disk
  - Annulus fibrosus
    - The flexible outer ring of the disk

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Spinal MSDs

- New use
- Misuse
- Overuse
- Disuse

FPST 3213 12

Classifications of spinal MSDs

- Discogenic: disc hernia (most common at L 4-5 and L 5-S1)
- Neurological: nerve irritation, compression and/or tumors involving nerve roots
- Muscular/ligamentous tension: resulting from stress and nerve or ligament tension
- Trauma: acute injury or cumulative type
- Strain: small tears within the muscle/tendon
- Postural imbalance: creates uneven stresses on the musculoskeletal system
- Spasm: muscle contraction that produces an uncontrolled contraction

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Classifications of spinal MSDs

- Weakness: poor muscle tone
- Myofascitis: inflammation and tenderness of the muscle and the sheaths that envelop the muscle known as the fascia
- Structural: spondylolysis – a defect of the bony segment joining the articulations above and below a given segment
- Scoliosis: abnormal curve of the spine
- Compression fractures
- Dislocation degenerative disease annular tears
- Osteoarthritis: degenerative disorder that affects the facet joints and disk
- Stenosis – narrowing of a channel.

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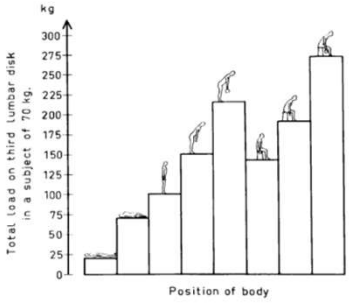
Lumbar disc pressures in different positions of the body



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Back Injuries Facts

- More than one million back injuries are sustained in the workplace every year
- Back injuries account for one in every five injuries and illnesses in the workplace

FPST 3213 16

Back Injury Facts

- Up to 1/3 of back injuries could be prevented through a better designed job workspace
- Back injuries made up 41% of ergonomic injury cases
- In the US, back disorders account for over 24% of all occupational injuries and illnesses involving days away from work
- US workers who suffered ergonomic injuries required an average of 12 days to recuperate before returning to work

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The Back

FPST 3213 18

The Back

FPST 3213 19

The Back

FPST 3213 20

The Back

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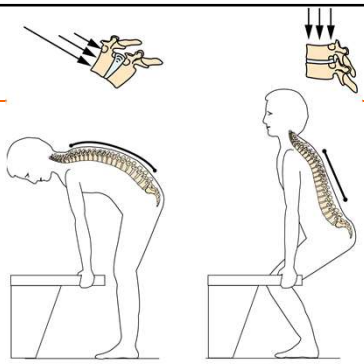
Is work the only exposure?

Spinal Loading vs Posture



Source: Grandjean, E., "Fitting The Task To The Man", Taylor & Francis, London, 1969

Posture: Proper Lifting Technique

smartdraw

IMPROPER TECHNIQUE

Proper lifting technique is crucial to avoiding lower back pain.

Improper lifting can cause muscle, disc and joint injuries.

Size up the load you are lifting. If it seems to large or heavy, do not attempt to lift the object yourself. Ask for assistance.

Don't stoop, which is to bend forward and down from the waist or the middle of the back.

Do not lead with the shoulders. This action may cause the twisting of the hips.

PROPER TECHNIQUE

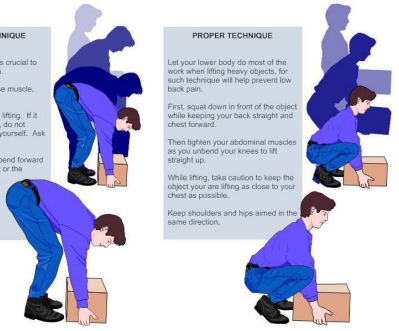
Let your lower body do most of the work when lifting heavy objects, for such technique will help prevent low back pain.

First, squat down in front of the object while keeping your back straight and chest forward.

Then tighten your abdominal muscles as you unbend your knees to lift straight up.

While lifting, take caution to keep the object your are lifting as close to your chest as possible.

Keep shoulders and hips aimed in the same direction.



NIOSH Hazard Evaluation Checklist Risk of Back Pain in Manual Tasks

Risk Factors (TABLE 2.7)	Yes	No
1. General		
1.1 Does the load handled exceed 23 kg?		
1.2 Is the object difficult to bring close to the body because of its size, shape, or bulk?		
1.3 Is the load hard to handle because it lacks handles or cut-outs or does it have slippery surfaces hard edges?		
1.4 Is the footing unsafe? For example, are the floors slippery, inclined, or uneven?		
1.5 Does the task require fast movement, such as throwing, swinging, or rapid walking?		
1.6 Does the task require stressful body postures such as stooping to the floor, twisting, reaching overhead, or excessive lateral bending?		
1.7 Is most of the load handled by only one hand, arm, or shoulder?		
1.8 Does the task require working in environmental hazards, such as extreme temperatures, noise, vibration, lighting, or airborne contaminants?		
1.9 Does the task require working in a confined area?		
2. Specific		
2.1 Does lifting exceed five lifts per minute?		
2.2 Does the vertical lift distance exceed 1 m?		
2.3 Do carries last longer than 1 min?		
2.4 Do tasks that require large sustained pushing or pulling forces exceed 30 s duration?		
2.5 Do extended reach static holding tasks exceed 1 min?		

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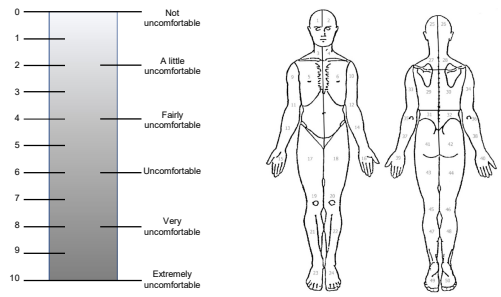
Body Diagram for Pain Rating



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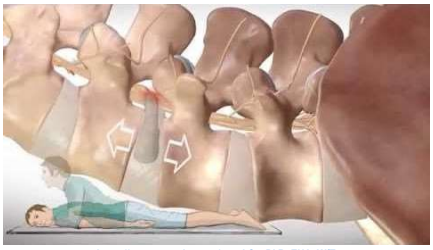
Chronic Low Back Pain



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

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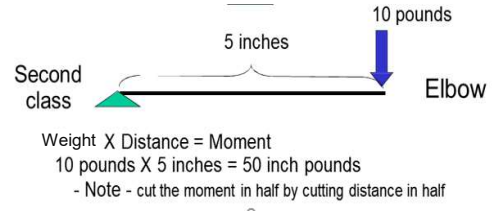
Why is closer better?



Weight X Distance = Moment
10 pounds X 5 inches = 50 inch pounds
- Note - cut the moment in half by cutting distance in half

NOTE: Moment = Force * Distance (N . in)
For purpose of the example we are assuming that Moment = Weight * Distance (in.lb force)

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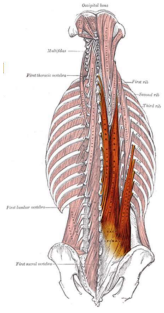
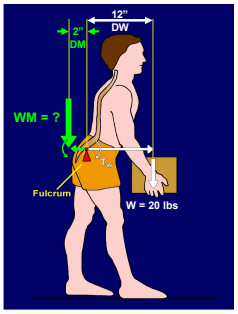
How much force is developed by erector spinae?





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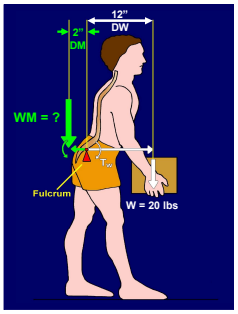
How much force is developed by erector spinae?

WM = ?

Moment 2 = Moment 1

(W) X (DW) = Moment 1

(WM) X (DM) = Moment 2



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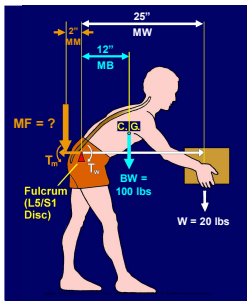
Add Reaching

How much force is developed by erector spinae?



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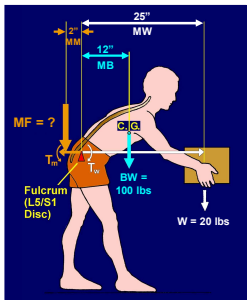
Add Reaching

MF = ?

Moment 2 = Moment 1 + Moment 3



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Conclusion

With a 20 lb box the erector spinae supports 120 lb.

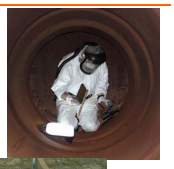
With reaching and a body weight of 100 lb in CG, the erector spinae supports 850 lb

Biomechanics

FPST 3213 33

Effects of Restricted Workspace on Spine Loading

- Underground Mines, Utility Vaults, Confined Spaces, cable handling
- Stooping, Kneeling, twisting
- 13-20% reduction in lifting capacity
- Tissue loading on the spine
- Static muscle fatigue



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Rules of Thumb

- If the load is not close, the pressure is gross.
- If the back is bent, one will not prevent.
- If muscles are slack, you will hurt your back.

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It's all about workplace design

The condition forces the behavior

FPST 3213 36

Text Neck Syndrome

FPST 3213 37

Text Neck Syndrome

FPST 3213 38

Could Tech Neck be the Cause of your Headaches or Neck Pain?

https://www.youtube.com/watch?v=yjVw6oLPuB0

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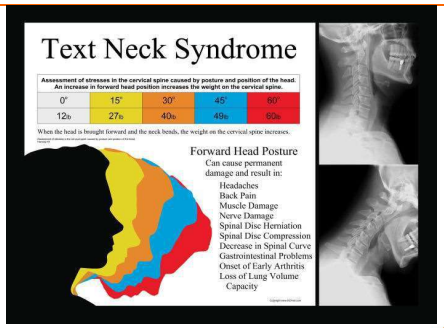
Text Neck Syndrome



Text Neck Syndrome

- The cervical vertebrae may form bone spurs for stability, ligaments become thicker, and muscles can become tightened to counteract the strain

Stand up Straight! Love Mom

Text Neck Syndrome

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Text Neck Syndrome

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Sitting is the New Smoking

FPST 3213 45

Sitting

- Tightened muscles
  - Leads to the neck, hip and shoulder flexors contracting resulting in stress, strain and muscle tension
- Weakness
  - Overstretched areas cause a lack of strength in the back, scapular stabilizers, buttocks, and core
- Decreased cardiovascular health
  - Being sedentary does not challenge the heart by pumping blood vigorously
  - Affect endurance, metabolism, blood pressure, cholesterol levels and overall cardiovascular health

Sitting

- Obesity risk increases
- Diabetes (type 2) risk increases
- Psychological stressors

Sitting

- Altered digestion
- Cancer risk increases
- Overall mortality

Is standing any better?

Standing

- Working regularly in a standing position
  - Sore feet
  - Leg swelling
  - Varicose veins
  - General muscular fatigue
  - Low back pain
  - Stiffness in the neck and shoulders
  - These are common complaints among sales people, machine operators, assembly-line workers and others whose jobs require prolonged standing.

Standing

- Keeping the body upright requires considerable muscular effort
- Standing reduces the blood supply to the loaded muscles
  - It is a static posture
- Causes blood pooling in the legs and feet

http://www.westfloridaveincenter.com/2018/01/can-varicose-veins-lead-complications/

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Some Advantages

- Reach is greater in standing that in sitting.
- Lumbar disc pressure are lower.
- It can be maintained with little muscular activity and requires no attention.

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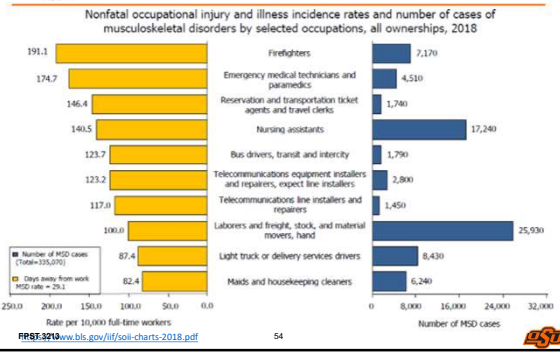
MSD Summary



FPST 3213 www.bls.gov/iif/soii-charts-2018.pdf 54

Statistics On Lifting Injuries

- Lifting Injuries Aren't Just Back Injuries

LIFTING RESULTS IN:

30% of Shoulder WMSDs

22% of Elbow WMSDs

43% of Back WMSDs

13% of Hand/Wrist WMSDs

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Hi-Risk Occupations

- Six occupations accounted for more than 25% of ergonomic injuries
  - Heavy and Tractor-Trailer Truck Drivers
  - Laborers and Freight
  - Stock and Material Movers
  - Nursing Assistants
  - Janitors and Cleaners
  - Registered Nurses

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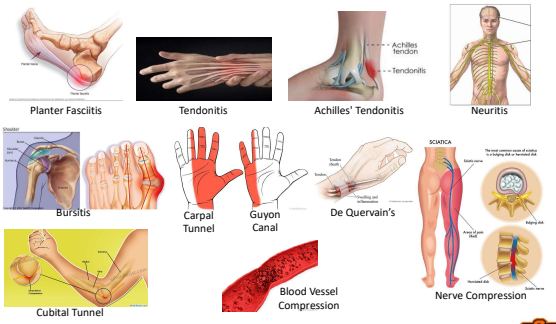
MSD Summary



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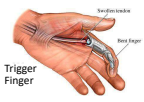
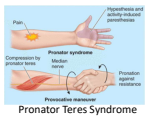
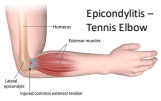
MSD Summary


Trigger Finger


White Finger (Raynaud's Disease)


Ganglion Cyst


Pronator Teres Syndrome


Epicondylitis – Tennis Elbow


Neck Tension Syndrome


Text Neck Syndrome


Thoracic Outlet Syndrome


Chronic Low Back Pain

FPST 3213 58

Minimizing musculoskeletal disorders

https://www.youtube.com/watch?v=u9eSSL6klsA

FPST 3213 59

To Do List

- HW 2
- Read Chapter 10

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