Musculo-Skeletal Disorders

Identifying Ergonomics Risks & Prevention Tactics

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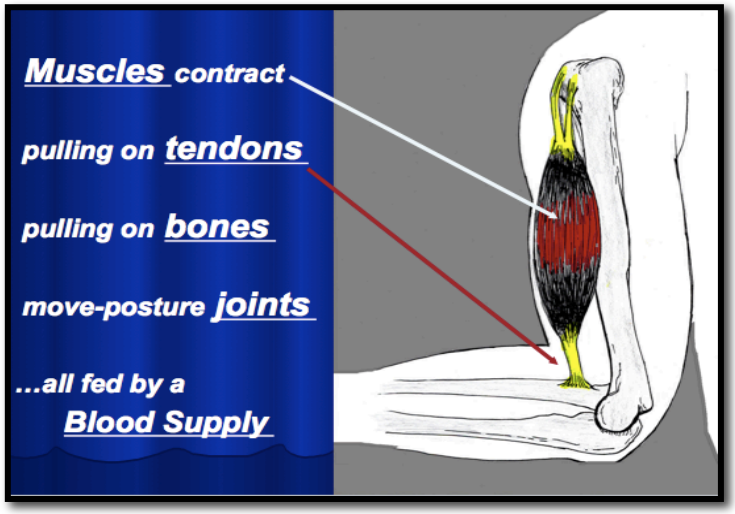
MUSCULO-SKELETAL DISORDERS (M.S.D. of the Neck-Arm & Low Back) :

Musculo-Skeletal Disorders (MSD): tendinitis, tennis elbow, golfer's elbow, rotator cuff, carpal tunnel, neck strain, low back pain. MSD's are epidemic in the workplace, AT 55% of Worker Comp claims and 65% of costs… BUT these are highly preventable !! Understanding how your musculo-skeletal system works, how it breaks down and wears out, and how to avoid and reverse that are key to reducing MSD in the workplace. Understanding musculo-skeletal AGING is also part of this.

YOUR MUSCULO-SKELETAL SYSTEM… How it works… How it breaks down… Over-use MSD:

WORK: Muscles contract… pulling on tendons… pulling on bones… moving or stabilizing joints… cushioned by cartilage… and held together with ligaments. KEY: These are all fed by a blood supply that delivers nutrients and oxygen for the tissues burn as fuel. This produces waste products (acids that become urine). The blood supply must remove the wastes produced by the work.
But if blood supply is not good, the acid wastes build up in the tissues causing irritation… over-use tendinitis !



The working-aging musculo-skeletal system

PAIN… Pain nerves react to chemical irritation (a build-up waste products in working tissues), or by mechanical over-load (such as pinching or pulling), or by lack of oxygen that feeds the tissues. In MSD, oxygen is blocked and acid wastes build up from work demands and poor blood flow to absorb acid wastes… or from the mechanical load of posture strain… or from muscle contraction, tendon tension, joint compression that block blood supply, oxygen delivery, and acid wastes cleanup. All these can lead to PAIN.

AGING-1… SCAR TISSUE … Every day work actions break a few microscopic fibers of muscles, tendons, joints, spinal discs. These heal with scar fibers… which are weaker and more brittle than the fibers they are healing. The build-up of scar fibers over time makes you gradually weaker, stiffer, more likely to be injured. This is aging and it starts about age 25.

Aging-2… DRY & BRITTLE… Water loss in tissues. Musculo-skeletal tissues are mostly water attached to proteins fibers. Water makes these tissues very ELASTIC. Elasticity allows tissues to absorb loading, bending, twisting, weight-bearing with minimal damage. But these tissues gradually lose water over time… which make tissues stiffer and weaker, more easily damaged with regular work. Loss of water and a build-up of scar fibers allows tissues to break down. This is **DEGENERATION. … AGING.**

But this is PREVENTABLE and REVERSIBLE ! We reverse aging by restoring ELASTICITY and BLOOD SUPPLY.

Aging & Degeneration… loss of tissue water & elasticity… gradual damage… BUT very reversible !

RE-DEFINING M.S.D and PREVENTION.:

MSD is caused by musculo-skeletal tissues not getting enough blood supply to support work demands. This forces tissues to work with not enough oxygen and a buildup of acid wastes. This causes pain, inflammation, and damage. Damage may not repair fast enough or good enough, resulting in reduced water and elasticity. Scar fibers build up as tissues try to heal with poor blood supply. Scar fibers do not tolerate ongoing work and easily break down. Some call MSD "repetitive motion injury." But this is not quite accurate because MSD is more often caused by prolonged unchanging POSTURE (sustained sitting, gripping, bending, or holding any position without enough break). This blocks blood supply to those working tissues, causing irritation and damage that lead to MSD.

We avoid and reverse degeneration and MSD by easing tissue loads with better posture and more effective work methods. We improve blood supply with better posture, frequently changing posture or swapping between work tasks so that more tissues take turns doing the work. We can give tissues a quick burst of blood supply with frequent brief "micro-stretches" to a few specific tissues. We can easily improve flexibility to reduce "drag" caused by tight tissues that strain posture and movement tasks. Tissues relax to get more circulation.

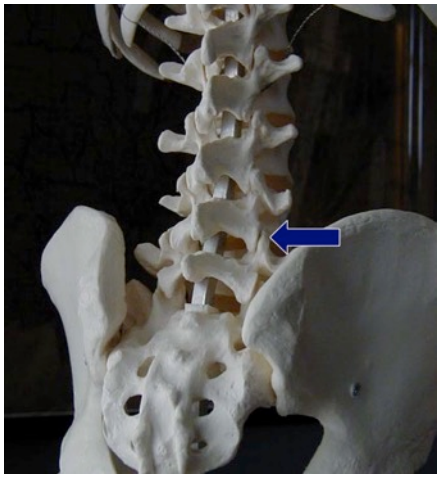
Work design (ergonomics) reduces MSD risks by making job tasks more efficient and less demanding. This can be very effective, BUT in too many cases ergonomics cannot be improved enough to avoid MSD. That is when employees must take steps to protect themselves. This includes constant attention to good posture, using safer lifting methods, changing posture or motion patterns often, and frequently micro-stretches to tissues that are working hard. Later, after-work recovery stretches will stimulate much better healing.

LOW BACK PAIN, STRAIN, DEGENERATION :

Lower back problems appear with prolonged sitting, prolonged or repeated bending, twisting, awkward lifting (heavy or frequent or low or high or combined with reach). Some focus on "lifting injury." But this is an incorrect term because back injury is usually the result of multiple issues that accumulate over time, weakening and stiffening the spine gradually over time, allowing injury to occur during lifting a seemingly minor load. There are many different back structures that become worn out, stressed, and injured.

The spine is a stack of bones (vertebrae) balanced upright. The spine must be MOBILE for movements and STABLE for posture. This is a difficult and demand set of demands on the spine, causing many potential problems, and vulnerable to age changes.

The bones are connected at FACET JOINTS, forming a pivot point for movement and posture. These joints run up the back of the spine left and right sides. They have very sensitive nerves to control balance, posture, and motion. But that sensitivity can create lots of pain with even minor injury. These small joints can become arthritic over time, growing bone spurs that can pinch nerves. Facet joints are stressed by prolonged postures, overhead work, and twisting. Degenerated discs can also stress these joints.



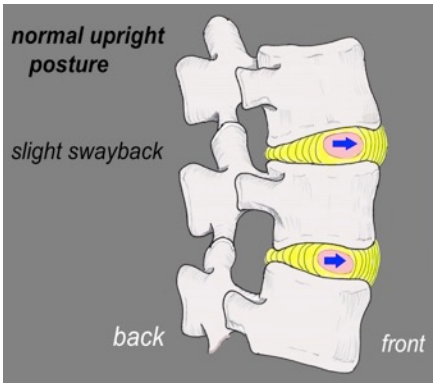
Rear view; FACET JOINTS

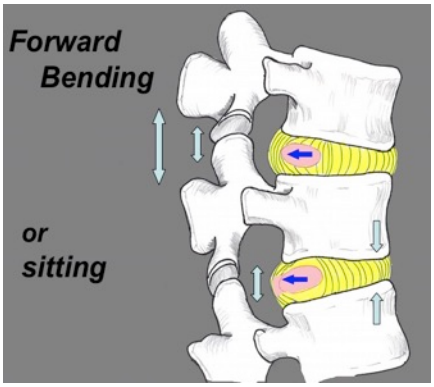
Front view; DISCS

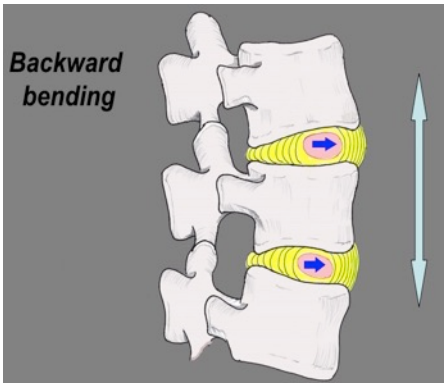
SPINAL DISCS:

Lots of problems come from the discs, directly and indirectly. Dscs are cushion pads between vertebrae, at the front ¾ of the vertebrae. They act as shock absorbers. They also act as ball bearings for the vertebrae to pivot on during bending motions.
When we are young, the discs are 80% water, to allow shock absorption and easy pivoting during bending. But as we get older (even by age 35) disc lose water and elasticity, so cannot absorb loads or bend as well as before. They get thin from water loss, shifting load to facet joints, causing strains and arthritis. As discs thin, bones sit closer together. This can squeeze nerves passing nearby. This degenerative disc disease. This can be improved with reduced posture stress and certain stretches.

In the center of the disc is a wet gel (nucleus) contained in a tough outer ring. Bending forward squeezes the front of the disc, pushing that gel back against the back wall of the disc. This wall is weak and tends to balloon out: a BULGING DISC. The gel can eventually break through, causing a RUPTURED DISC. This is usually not a disaster and is quite reversible. Stretching backward tends to reverse this, pulling the gel back to the center of the disc. The front of the disc is very strong and usually does not bulge.



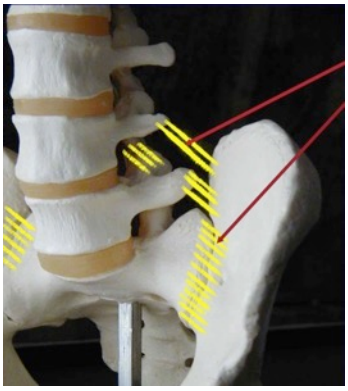




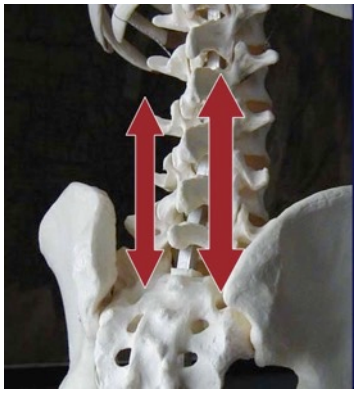
Side view

Ligaments; Ligaments are elastic straps that allow reasonable movement while holding all the bones and joints together. You sprain ligaments by forcing movement or posture beyond what the ligaments allow. This hurts (a lot) but heals quickly, but with scar tissue that is weaker and stiffer than the original ligaments. That leaves a weak-stiff area more easily sprained again.

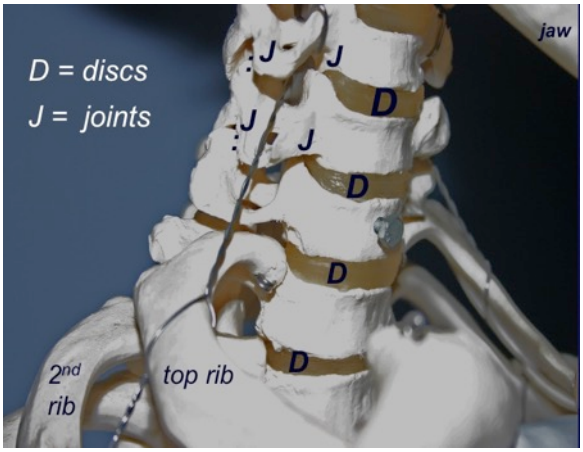
Muscles… Muscles have two jobs: move the spine, and hold the spine upright (posture). Pain develops from repeated motions, heavy loading, sustaining a posture too long can all overwork muscle, causing buildup of waste products and tissue damage. Many other problems can cause muscles to go into painful spasms. Muscle spasm is usually caused by other tissues that are strained.



Ligament bind bones & joints



Back muscles move & stabilize spine



NECK vertebrae, discs, joints (front right view)

NECK WORK :

The neck is much more mobile than the low back. It is not designed for heavy loads. But a rather heavy head puts a load on the neck. The weight of working arms also hangs from neck structures, adding more all-day loading. These loads are on a very mobile and somewhat unstable sensitive neck. Smaller joints and discs are easily strained. Degeneration and wear damage are common.

NECK & BACK MSD PROBLEMS:

By the time you feel pain, there are often several structures that hurt. Disc issues can stress joints, which can stress ligaments which can cause muscle spasm. Also, you can LOTS of damage, but NO pain. The level of pain often does not match the damage

X-RAYs and MRI: Shocking… MRIs often LIE ! Bulging or degenerated disc or arthritis on MRI… are often NOT the source of pain !! X-rays & MRI often make people believe they are disabled. This is often wrong. MOST adults over age 45 with NO BACK PAIN have degenerated discs, bulging discs, arthritis on x-ray or MRI… but NO pain. So… x-rays and MRI findings for these are not considered valid unless the patient has worsening neurological symptoms in their legs. Most back pain is mechanical and can be corrected with simple exercises and habit changes. Pain goes away (while the x-ray & MRI still shows disc & arthritis findings)…
Do NOT let the x-ray & MRI falsely disable you !! They are NOT valid unless you have worsening neurological leg symptoms.

Degenerated Discs… Discs are 80% water when you are 25, but can drop to 40% water by age 50. The discs get thinner. This increases loads on facet joints and lead to arthritis and easier sprains. This is at least partially reversible with certain stretches, described later. This is caused by aging, inactivity, years of prolonged sitting, years of repeated or sustained bending.

Bulging or Ruptured Discs… The gel in center of disc (nucleus) pushes out back wall of disc, or leaks through back wall. This can press on nearby nerves, causing pain down arm (neck disc) or leg (low back disc). This sometimes requires surgery …but rarely. Most will resolve with certain stretches. Caused by repeated or sustained bending, lifting, and excessive sitting,

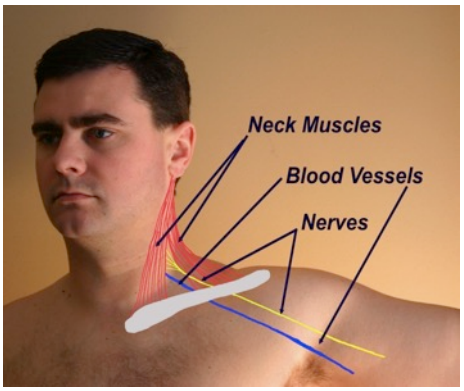
Soft Tissue Sprain (ligament or muscle)… Sprained tissues caused by loading in an awkward or extreme or prolonged position. Heals with rest, followed by stretches, then strengthening. In some cases, pain nerves can get overstimulated and out of control.

Facet joint sprain… Caused by overhead work, twisting, sideways loading. Hurts lots; heals with rest, followed by activity.

Degenerative Arthritis… Degeneration of facet joints, which can squeeze nerves to arms. Caused by slouched posture, aging, years of prolonged standing or sitting, overhead work, twisting, inactivity. Improved by proper posture, stretching, and stability exercises.

STRESS… Stress often adds to pain. It may not be the cause of your pain, but it can make MSD pain lots worse. Pain, poor sleep, lost work causes stress, which causes spasm, causing more pain, causing more stress. Just being aware of this can help recovery.

NECK-TO-SHOULDER PAIN… Many "shoulder strains" are actually a neck issue. Pain at shoulder blade or in upper shoulder between neck and shoulder joint are usually NECK issues. Shoulder and neck often irritate each other. Many arm-hand problems have inputs from neck due to pinched nerves and neck postures that can reduce blood supply to a working arm-hand.



Nerves & blood vessels to arm pass through neck muscles… and can be squeezed by poor posture.

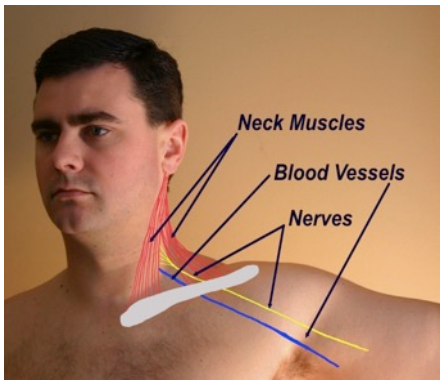
NECK-ARM OVERUSE, TENDINITIS: important new definition!

WORK: Muscle contract, pull on tendons, move joints, or hold a sustained position (such as sitting or gripping). This reduces blood supply, trapping acid wastes, causing inflammation, scarring and degeneration while reducing repair. MSD is a blood supply issue. We prevent MSD by boosting blood supply to these working tissues. It is easy. It is effective. Several tactics are available.

NECK POSTURE effect as an UPPER EXTREMITY ERGONOMICS RISK:

SLOUCHING… ROUND-SHOULDERS… FORWARD HEAD POSTURE: A common posture habit of holding head ahead of neck and shoulders. This strains upper back muscles, pinches joints in upper neck, compresses discs in middle neck, and squeezes shoulder rotator cuff tendons. This also causes muscles on side of neck to tighten, squeezing nerves and blood vessels passing through to arm structures. This is "thoracic outlet compression" risking arm MSD such as tendinitis and carpal tunnel syndrome.


Forward head posture

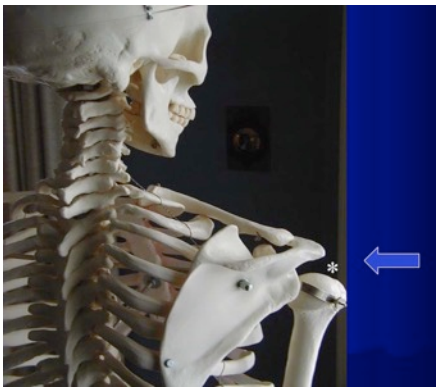


Thoracic outlet compression

PREVENTION: Position work higher for more upright head posture. Frequently switch between sitting and standing. Frequent job task rotation. Rest arms on work surface during hand tasks. Neck micro-stretches. Reminder self often to "BE AN INCH TALLER."

Arm support during neck-hand work

ROTATOR CUFF: This is overuse tendinitis at shoulder tendons located between bones of shoulder in a tightly-confined space. Irritation causes swelling and pinching that blocks blood supply. Very painful, disabling, costly, and difficult to treat! Caused by reaching that is: too high… too far… too often… too prolonged… or with a load in your hand (tools, etc.).


cuff tendons pinched between bones


Reaching

PREVENTION: Make reach lower, closer, less often, less prolonged, and lighter. Job task rotation. Shoulder micro-stretches.

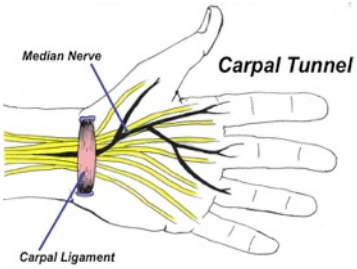
TENNIS ELBOW: This is actually a tendinitis of WRIST muscles where they originate on outside of elbow. Caused by loading the wrist-hand. Loads are held by wrist muscles-tendons that become strained up at elbow where wrist muscles start. Causes may be heavy loads lifted or light loads held for hours (such a computer mouse work). PREVENTION: Reduce load or holding time; change work postures (switch between mouse and trackball hourly); work task rotation; wrist-arm micro-stretches.

GOLFER'S ELBOW: Similar to tennis elbow except on inside of elbow. Caused by loading muscles of grip, or at pronator muscle (turns forearm over); prolonged, repeated, forceful grip; turning or prolonged holding palm-up position.

Tennis elbow wrist load


Golfer's elbow grip & twist

WRIST-HAND-THUMB-CARPAL TUNNEL: Wrist and thumb overuse comes from grip, pinch, wrist bent, vibration, thumb actions. These sensitive structures are easily irritated. Swelling at wrist or base of thumb can compress nerves entering hand (carpal tunnel) causing pinched nerve that (sometimes) requires surgery. Several medical issues add to this risk (pregnancy, diabetes, smoking, thyroid problems, obesity, wrist or thumb arthritis). PREVENTION: Reduce force or time spent in grip or pinch; use tools that allow wrist to be in neutral position during grip; reduce vibration; improve neck posture; rotate job tasks; micro-stretches at wrist.



ERGO RISKS LIST (upper body) :
Neck position-motion… Forward Head-Slouch… Shoulder Reach… Wrist Loading… Grip… Pinch… Bent Wrist… Vibration… When these are repeated, prolonged, or forceful. Prolonged Sitting… Prolonged Standing… Limited variety of work tasks.

ERGO RISK LIST (lower extremity) :
Similar overuse issues arise at hip, knee, ankle, heel, Achilles tendon. Risk factors include: prolonged standing… stand or walk on cement-metal floor… poor footwear… flat (pronated) feet… tight muscles at hip, hamstrings, calf… stairs-ladders… foot switch use. CORRECTIONS include specific stretches at hip rotators, hamstrings, calf; proper footwear; posture variety; anti-fatigue floor mats or insoles; rotate postures and work tasks.

LOW BACK ERGONOMICS …

LOW BACK ERGO RISKS: Prolonged Sitting… Poor chair design…Prolonged standing… Bending… Twisting… Lifting that is low, high, far, frequent, awkward, or heavy.

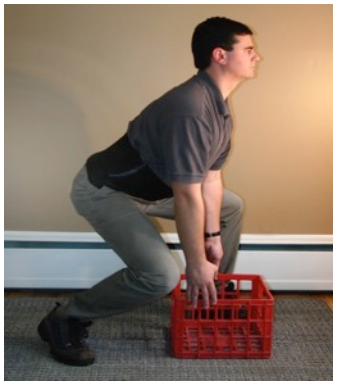
Lifting… Reduce (even only a little) how HEAVY is the load, how LOW it is lifted, how HIGH it is lifted, how much you TWIST, how FAR away load is held, how OFTEN you lift and how AWKWARD is the GRIP. Using lift-tables, turntable, rollers, hoists can reduce lifting demands. If lifting is excessive, redesign the job to automate or mechanize or eliminate human lifting. Be creative.

Sitting… Sitting is a huge spine risk. Even perfect posture is bad if it is prolonged and unchanging. Instead, change your posture frequently. Adjust seat up or down a few inches every half hour. Better yet, try to switch between sitting and standing often.

lift table reduces bending load


Sit-stand desk

BODY MECHANICS… Lift perfectly !
Choose NOT to be injured. It is your choice. Lift correctly. Feet wide and pre-positioned to minimize twisting.. Get close to load and hold load close to body.. Tuck chin in, pull shoulders back, arch low back in create mild swayback as you squat at knees. Pull load close, tighten your gut and butt as you lift. Then put load down in the same manner. If very heavy: get help or use a device !


Wide stance; load close; arch back in slightly; squat. Choose to lift correctly!

POSTURE RISKS… Change awkward postures often !
Many strains occur from holding awkward position too long. Listen to your body. When you feel discomfort, stop, get out of that position, stretch in the opposite direction 10 seconds, then resume the work task. Very simple but very effective self-protection !

Frequently stop & stretch !!

LOW BACK ERGO RISKS LIST :
Prolonged Sitting… Prolonged standing… Bending… Twisting… Lifting that is frequent, low, high, far, awkward, or heavy… Workers with poor flexibility, strength, endurance-fitness, training.

GENERAL PREVENTION STRATEGIES…

ERGONOMICS… Your best experts? The employees doing the work! They are the best source of ideas on how to make the work easier (less stress and damage). Give them basic ergonomics EDUCATION, then empower them to make and implement their suggestions. Be aware not all ergonomics risks can be fixed. That requires alternatives to ergonomics… such as…

EXPOSURE REDUCTION… This can be very effective alternative when ergonomic changes are not an option. Reduce MSD risk exposure time by: switch between sit & stand often… job rotation… rotate how job is done (example: switch between mouse & trackball hourly)… alter sitting position by changing chair height often. WORK VARIETY greatly reduce MSD risks.

MICRO-STRETCHES?… Some say workplace stretching is not effective. But that opinion is based on old poorly-designed studies. Newer studies and our experience shows this can work very well… IF done correctly !! Also, some workplaces are doing incorrect stretches. Micro-stretches are set of 6-8 stretches done only 10 seconds each… specifically selected per job risks…professionally taught by a physical therapist… IT WORKS if done RIGHT ! New research and our experience at 500 workplaces support this.

These work… but only if properly selected and professionally taught !!

WORKER EDUCATION: Go beyond ergonomics, to include worker self-care education. Workers respond very well to properly presented motivational training on how to take care of the aches and pains they live with daily. Physical therapists are trained to present programs teaching personal ergonomics skills, workplace micro-stretching, and after-work recovery stretches. Workers hunger for this information because they do NOT want to hurt. They want to have a life after work. Ergonomics does not succeed without workplace education… teaching workers not just what to do, but WHY to do it. Once they understand WHY they hurt and WHY to do certain prevention tactics… then they willing follow our advice.

This includes attention to worker fitness and wellness. Flexibility, strength, and endurance are required if we are to tolerate work. As we age, many parts wear out. We are all aging. But degeneration of the musculo-skeletal system can be slowed and even somewhat reversed. But workers must be educated and motivated to take those very few minutes each day to rebuild the flexibility strength, endurance that we all lose each day from aging and degeneration. This is the teaching role of your physical therapist. What is the easiest and most effective? Three minutes of stretching at the start and end of each day… and go for a 20-minute walk.

Aging Worker Wellness Program

The author: Lauren Hebert, Doctor of Physical Therapy, Board Certified Orthopedic Specialist, MSD ergonomics and prevention specialist, has 40 years of experience addressing workplace MSD. He has consulted for more than 500 workplaces nationwide and has trained hundreds of other physical therapists how to succeed at this. Contact: Lhebertpt@prexar.com www.impacc.com

ERGONOMICS RISKS ANALYSIS…

People in the workplace need to assess jobs with MSD claims or obvious risk factors. There are several formats for performing a formal-structured ergonomics risk analysis. Some are useful; others not so much. Some are easy to perform: others not so much. The ones we use include… 1. Our own MSD Risks Checklist (IMPACC); 2. WISHA Lifting Calculator; 3. REBA or RULA.

Our own MSD Risks Checklist is simple but comprehensive. We simply check off the listed MSD risks observed on the job, with no math scores or calculations. It simply provides a list of risks to target for corrections. How to use form is obvious and self-explanatory. For lifting jobs, we use WISHA to quantify the level of lifting risks. It is obvious how to do the simple calculation. See full-size appendix.

MSD RISK ANALYSIS CHECKLIST

Job _____

code… R = repetitive S = sustained F = forceful A = awkward X = present

___ Sustained static standing ___ Standing on cement, metal, vibrating surface
___ Standing mostly on one leg (e.g.. foot switch operation)
___ Sustained neck posture: prolonged, ___ awkward _____
___ Sustained low back posture bent, twisted, awkward _____
___ Kneeling or squatting
___ Prolonged sitting
___ Poor chair design or ___ Improper adjustment _____

___ Forward head posture; rounded-shoulders; slouching habits
___ Lack of upper extremity weight bearing support on work surface
___ Keyboard, mouse or other data input (prolonged) _____
___ Shoulder elevation: high, far, repeated, sustained, or with load _____
___ Elbows bent more > 90 degrees: sustained, repeated or loaded
___ Forearm supinated: sustained, repeated, extreme or loaded
___ Loading-lifting across wrist: sustained, repeated, heavy (tennis elbow loads)_____
___ Wrist flexion or deviation: sustained, repeated, extreme or loaded
___ Gripping _____
___ Pinching _____
___ Combining thumb pinch with wrist deviation
___ Vibration or ___ Contact stress (pounding with hand or knee) _____
___ Repeating same motion every few seconds, or cycle of motions
Describe _____
___ Improper tool selection and-or use _____

Materials handling loads (lift-push-pull-carry) that are:..
___ Heavy.. wt = _____ ave. and _____max.
___ Frequent. frequency of lifts = _____per hr; or _____ per day ____ prolonged periods lifting
___ High or Low.. low ht = _____ high ht = _____
___ Long arc twisted. degrees twisted = _____
___ Lifting/carrying across obstructions _____
___ With difficult grip or ___ cumbersome shape _____
___ Workers using unsafe lifting techniques _____
___ Pushing or pulling _____

___ Minimal variety of activity, posture, movement patterns, tasks

Demographics (age, sex, longevity-turnover) _____
Production demands _____
Training _____
Other issues _____

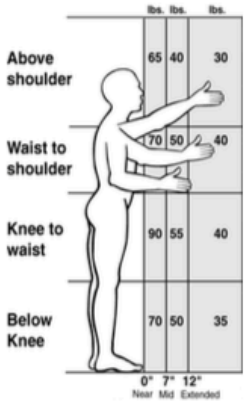
Examiner _____ Date _____

Calculator for analyzing lifting operations

Company _____ Evaluator _____
Job _____ Date _____

1 Enter the weight of the object lifted. Weight Lifted ____ lbs.

2 Circle the number on a rectangle below that corresponds to the position of the person's hands when they begin to lift or lower the objects.



3 Circle the number that corresponds to the times the person lifts per minute and the total number of hours per day spent lifting.

Note: For lifting done less than once every five minutes, use 1.0

How many lifts per minute?	How many hours per day? 1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 min	1.0	0.95	0.85
1 lift every min	0.95	0.9	0.75
2-3 lifts every min	0.9	0.85	0.65
4-5 lifts every min	0.85	0.7	0.45
6-7 lifts every min	0.75	0.5	0.25
8-9 lifts every min	0.6	0.35	0.15
10+ lifts every min	0.3	0.2	0.0

4 Circle 0.85 if the person twists more than 45 degrees while lifting. 0.85

Otherwise circle 1.0

5 Copy below the numbers you have circled in steps 2, 3, and 4.

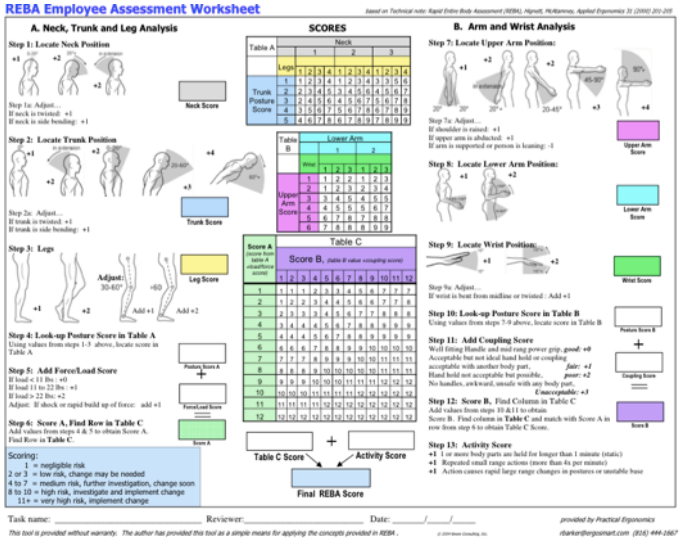
lbs. (Step 2) X ____ (Step 3) X ____ (Step 4) = Lifting Limit ____ lbs.

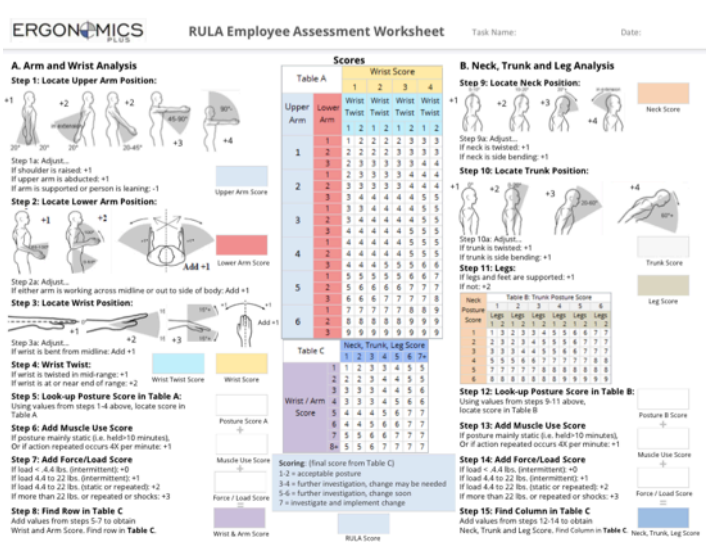
6 Is the Weight Lifted (1) less than the Lifting Limit (5) Yes – OK No – HAZARD

Department of Labor and Industries

Note: If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to:
1. Analyze the 2 worst case lifts—the heaviest object lifted and the lift done in the most awkward posture.
2. Analyze the most commonly performed lift. In Step 3, use the frequency and duration for all the lifting done in a typical workday.

REBA and RULA are a bit more complex to calculate, but not difficult to learn. There are several on-line tutorials for doing these. The only advantage of REBA-RULA over our MSD Risks Checklist is they "score" the overall MSD risk of a job. See appendix.





MSD RISK ANALYSIS CHECKLIST

Job _____

_____

_____

code… R = repetitive S = sustained F = forceful A = awkward X = present

___ Sustained static standing ___ Standing on cement, metal, vibrating surface
___ Standing mostly on one leg (e.g.. foot switch operation)
___ Sustained neck posture: prolonged, ___ awkward _____
___ Sustained low back posture bent, twisted, awkward _____
___ Kneeling or squatting
___ Prolonged sitting
___ Poor chair design or ___ Improper adjustment _____

___ Forward head posture; rounded-shoulders; slouching habits
___ Lack of upper extremity weight bearing support on work surface
___ Keyboard, mouse or other data input (prolonged) _____
___ Shoulder elevation: high, far, repeated, sustained, or with load _____
___ Elbows bent more > 90 degrees: sustained, repeated or loaded
___ Forearm supinated: sustained, repeated, extreme or loaded
___ Loading-lifting across wrist: sustained, repeated, heavy (tennis elbow loads)_____
___ Wrist flexion or deviation: sustained, repeated, extreme or loaded
___ Gripping _____
___ Pinching _____
___ Combining thumb pinch with wrist deviation
___ Vibration or ___ Contact stress (pounding with hand or knee) _____
___ Repeating same motion every few seconds, or cycle of motions
Describe _____
___ Improper tool selection and-or use _____
_____

Materials handling loads (lift-push-pull-carry) that are:..
___ Heavy.. wt = _____ ave. and _____max.
___ Frequent. frequency of lifts = _____per hr; or _____ per day ____ prolonged periods lifting
___ High or Low.. low ht = _____ high ht = _____
___ Long arc twisted. degrees twisted = _____
___ Lifting/carrying across obstructions _____
___ With difficult grip or ___ cumbersome shape _____
___ Workers using unsafe lifting techniques _____
___ Pushing or pulling _____

___ Minimal variety of activity, posture, movement patterns, tasks

Demographics (age, sex, longevity-turnover) _____
_____
Production demands _____
Training _____
Other issues _____
_____
_____

Examiner _____ Date _____

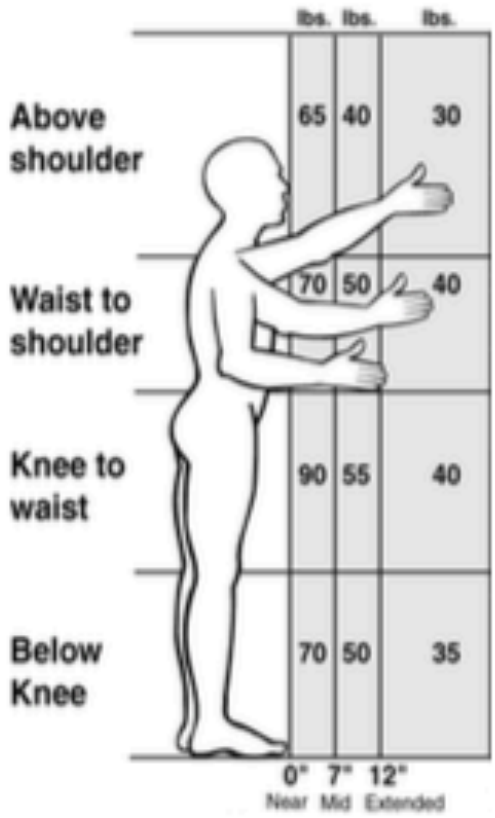
Calculator for analyzing lifting operations

Company		Evaluator	
Job		Date	

1 Enter the weight of the object lifted.

Weight Lifted
lbs.

2 Circle the number on a rectangle below that corresponds to the position of the person's hands when they begin to lift or lower the objects.



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3 Circle the number that corresponds to the times the person lifts per minute and the total number of hours per day spent lifting.

Note: For lifting done less than once every five minutes, use **1.0**

How many lifts per minute?	How many hours per day?		
	1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 min	1.0	0.95	0.85
1 lift every min	0.95	0.9	0.75
2-3 lifts every min	0.9	0.85	0.65
4-5 lifts every min	0.85	0.7	0.45
6-7 lifts every min	0.75	0.5	0.25
8-9 lifts every min	0.6	0.35	0.15
10+ lifts every min	0.3	0.2	0.0

4 Circle 0.85 if the person twists more than 45 degrees while lifting. 0.85

Otherwise circle 1.0

5 Copy below the numbers you have circled in steps 2, 3, and 4.

____ lbs.	X	____	X	____	=	Lifting Limit
Step 2		Step 3		Step 4		____ lbs.

6 Is the Weight Lifted (1) less than the Lifting Limit (5)

Yes – OK
No – HAZARD

Note: If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to:

1. Analyze the 2 worst case lifts—the heaviest object lifted and the lift done in the most awkward posture.
2. Analyze the most commonly performed lift. In Step 3, use the frequency and duration for all the lifting done in a typical workday.

REBA Employee Assessment Worksheet

based on Technical note: Rapid Entire Body Assessment (REBA), Hignett, McAtamney, Applied Ergonomics 31 (2000) 201-205

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a: Adjust…
If neck is twisted: +1
If neck is side bending: +1

Neck Score

Step 2: Locate Trunk Position

Step 2a: Adjust…
If trunk is twisted: +1
If trunk is side bending: +1

Trunk Score

Step 3: Legs

Leg Score

Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above, locate score in Table A

Posture Score A

Step 5: Add Force/Load Score

If load < 11 lbs : +0
If load 11 to 22 lbs : +1
If load > 22 lbs: +2
Adjust: If shock or rapid build up of force: add +1

Force/Load Score

Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A.
Find Row in **Table C**.

Score A

Scoring:
1 = negligible risk
2 or 3 = low risk, change may be needed
4 to 7 = medium risk, further investigation, change soon
8 to 10 = high risk, investigate and implement change
11+ = very high risk, implement change

SCORES

Table A		Neck											
		1				2				3			
	Legs	1	2	3	4	1	2	3	4	1	2	3	4
Trunk Posture Score	1	1	2	3	4	1	2	3	4	3	3	5	6
	2	2	3	4	5	3	4	5	6	4	5	6	7
	3	2	4	5	6	4	5	6	7	5	6	7	8
	4	3	5	6	7	5	6	7	8	6	7	8	9
	5	4	6	7	8	6	7	8	9	7	8	9	9

Table B		Lower Arm					
		1			2		
	Wrist	1	2	3	1	2	3
Upper Arm Score	1	1	2	2	1	2	3
	2	1	2	3	2	3	4
	3	3	4	5	4	5	5
	4	4	5	5	5	6	7
	5	6	7	8	7	8	8
	6	7	8	8	8	9	9

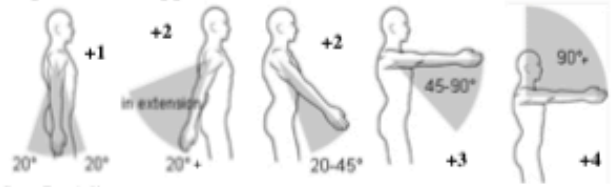
Score A (score from table A +load/force score)	Table C: Score B, (table B value +coupling score)											
	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	5	6	7	7	7
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	3	4	5	6	7	7	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9
6	6	6	6	7	8	8	9	9	10	10	10	10
7	7	7	7	8	9	9	9	10	10	11	11	11
8	8	8	8	9	10	10	10	10	10	11	11	11
9	9	9	9	10	10	10	11	11	11	12	12	12
10	10	10	10	11	11	11	11	12	12	12	12	12
11	11	11	11	11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12	12	12	12	12

Table C Score + Activity Score

Final REBA Score

B. Arm and Wrist Analysis

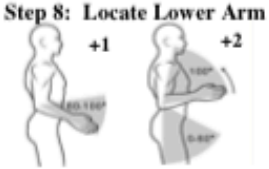
Step 7: Locate Upper Arm Position:



Step 7a: Adjust…
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

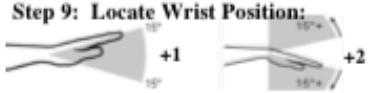
Upper Arm Score

Step 8: Locate Lower Arm Position:



Lower Arm Score

Step 9: Locate Wrist Position:



Wrist Score

Step 9a: Adjust…
If wrist is bent from midline or twisted : Add +1

Step 10: Look-up Posture Score in Table B

Using values from steps 7-9 above, locate score in Table B

Posture Score B

Step 11: Add Coupling Score

Well fitting Handle and mid rang power grip, ***good: +0***
Acceptable but not ideal hand hold or coupling acceptable with another body part, ***fair: +1***
Hand hold not acceptable but possible, ***poor: +2***
No handles, awkward, unsafe with any body part, ***Unacceptable: +3***

Coupling Score

Step 12: Score B, Find Column in Table C

Add values from steps 10 &11 to obtain Score B. Find column in **Table C** and match with Score A in row from step 6 to obtain Table C Score.

Score B

Step 13: Activity Score

+1 1 or more body parts are held for longer than 1 minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range changes in postures or unstable base

Task name: _____ Reviewer:_____ Date: _____/_____/_____

provided by Practical Ergonomics

rbarker@ergosmart.com (816) 444-1667

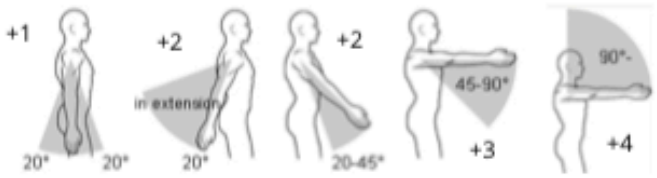
ERGONOMICS PLUS

RULA Employee Assessment Worksheet

Task Name: Date:

A. Arm and Wrist Analysis

Step 1: Locate Upper Arm Position:



Step 1a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

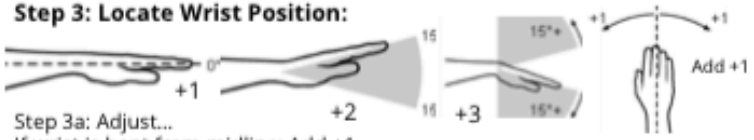
Upper Arm Score

Step 2: Locate Lower Arm Position:

Lower Arm Score

Step 2a: Adjust...
If either arm is working across midline or out to side of body: Add +1

Step 3: Locate Wrist Position:



Step 3a: Adjust...
If wrist is bent from midline: Add +1

Step 4: Wrist Twist:

If wrist is twisted in mid-range: +1
If wrist is at or near end of range: +2

Wrist Twist Score

Wrist Score

Step 5: Look-up Posture Score in Table A:

Using values from steps 1-4 above, locate score in Table A

Posture Score A

+

Step 6: Add Muscle Use Score

If posture mainly static (i.e. held>10 minutes),
Or if action repeated occurs 4X per minute: +1

Muscle Use Score

+

Step 7: Add Force/Load Score

If load < .4.4 lbs. (intermittent): +0
If load 4.4 to 22 lbs. (intermittent): +1
If load 4.4 to 22 lbs. (static or repeated): +2
If more than 22 lbs. or repeated or shocks: +3

Force / Load Score

=

Step 8: Find Row in Table C

Add values from steps 5-7 to obtain Wrist and Arm Score. Find row in **Table C**.

Wrist & Arm Score

Scores

Table A

Upper Arm	Lower Arm	Wrist Score 1		2		3		4	
		Wrist Twist 1	2	1	2	1	2	1	2
1	1	1	2	2	2	2	3	3	3
	2	2	2	2	2	3	3	3	3
	3	2	3	3	3	3	3	4	4
2	1	2	3	3	3	3	4	4	4
	2	3	3	3	3	3	4	4	4
	3	3	4	4	4	4	4	5	5
3	1	3	3	4	4	4	4	5	5
	2	3	4	4	4	4	4	5	5
	3	4	4	4	4	4	5	5	5
4	1	4	4	4	4	4	5	5	5
	2	4	4	4	4	4	5	5	5
	3	4	4	4	5	5	5	6	6
5	1	5	5	5	5	5	6	6	7
	2	5	6	6	6	6	7	7	7
	3	6	6	6	7	7	7	7	8
6	1	7	7	7	7	7	8	8	9
	2	8	8	8	8	8	9	9	9
	3	9	9	9	9	9	9	9	9

Table C

Wrist / Arm Score	Neck, Trunk, Leg Score 1	2	3	4	5	6	7+
1	1	2	3	3	4	5	5
2	2	2	3	4	4	5	5
3	3	3	3	4	4	5	6
4	3	3	3	4	5	6	6
5	4	4	4	5	6	7	7
6	4	4	5	6	6	7	7
7	5	5	6	6	7	7	7
8+	5	5	6	7	7	7	7

Scoring: (final score from Table C)
1-2 = acceptable posture
3-4 = further investigation, change may be needed
5-6 = further investigation, change soon
7 = investigate and implement change

RULA Score

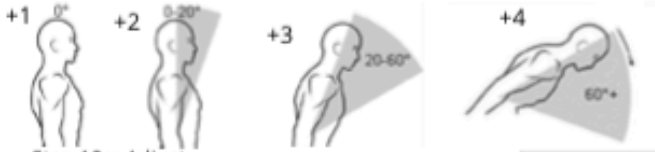
B. Neck, Trunk and Leg Analysis

Step 9: Locate Neck Position:

Neck Score

Step 9a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

Step 10: Locate Trunk Position:



Trunk Score

Step 10a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Step 11: Legs:

If legs and feet are supported: +1
If not: +2

Leg Score

Table B: Trunk Posture Score

Neck Posture Score	1 Legs 1	2	2 Legs 1	2	3 Legs 1	2	4 Legs 1	2	5 Legs 1	2	6 Legs 1	2
1	1	3	2	3	3	4	5	5	6	6	7	7
2	2	3	2	3	4	5	5	5	6	7	7	7
3	3	3	3	4	4	5	5	6	6	7	7	7
4	5	5	5	6	6	7	7	7	7	7	8	8
5	7	7	7	7	7	8	8	8	8	8	8	8
6	8	8	8	8	8	8	8	9	9	9	9	9

Step 12: Look-up Posture Score in Table B:

Using values from steps 9-11 above, locate score in Table B

Posture B Score

+

Step 13: Add Muscle Use Score

If posture mainly static (i.e. held>10 minutes),
Or if action repeated occurs 4X per minute: +1

Muscle Use Score

+

Step 14: Add Force/Load Score

If load < .4.4 lbs. (intermittent): +0
If load 4.4 to 22 lbs. (intermittent): +1
If load 4.4 to 22 lbs. (static or repeated): +2
If more than 22 lbs. or repeated or shocks: +3

Force / Load Score

=

Step 15: Find Column in Table C

Add values from steps 12-14 to obtain Neck, Trunk and Leg Score. Find Column in **Table C**.

Neck, Trunk, Leg Score