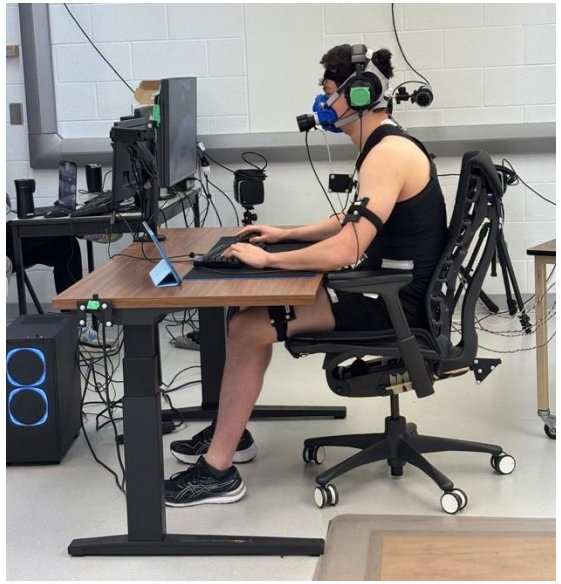


HOW CAN SOMETHING SEEMINGLY SO HARMLESS HURT SO MUCH? A LOOK AT SEATED WORK.

Jack P. Callaghan PhD, CCPE, FCSB, FCAHS

Canada Research Chair in Spine Biomechanics & Injury Prevention

Canada Research Chairs
www.chairs-chaires.gc.ca

UNIVERSITY OF WATERLOO | FACULTY OF HEALTH

CRE-MSD
Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

MSD PREVENTION GUIDELINE FOR ONTARIO

TALK OVERVIEW

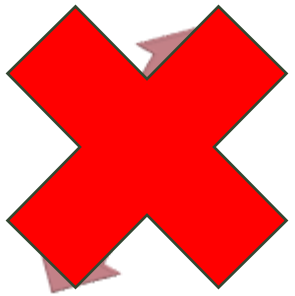
- Disclaimer
- Sedentary Work Exposures Background
- Office Work exposures and best practice
- Police Cruiser MDT Related Work – where safety and safer conflict
- MSD Resources

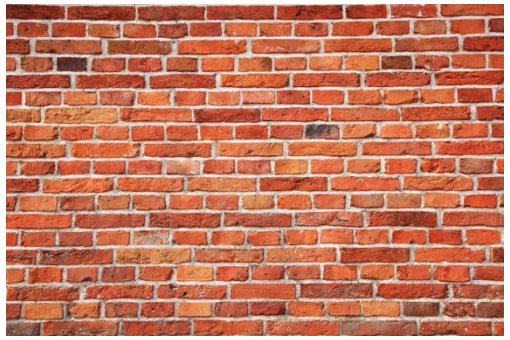
TALK OVERVIEW

- Disclaimer
- Sedentary Work Exposures Background
- Office Work exposures and best practice
- Police Cruiser MDT Related Work – where safety and safer conflict
- MSD Resources

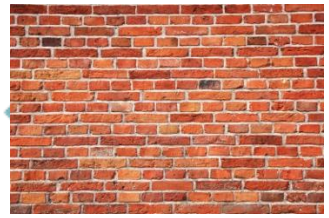
DISCLAIMER

MDT and Peripherals





User Ergonomics



Vehicle Safety

TALK OVERVIEW

- Disclaimer
- **Sedentary Work Exposures Background**
- Office Work exposures and best practice
- Police Cruiser MDT Related Work – where safety and safer conflict
- MSD Resources

Sitting and Standing MSD Risk

Time

Sitting & Low Back MSDs

- When "quality" of seated exposures are factored
  - Leisure + Work combined increased LBP reporting (Nourbakhsh et al., 2001)
  - Constrained seated driving postures 6x increase in lost time (Porter & Gyi, 2002)
  - Objectively measure time (Gupta et al., 2015)
    - Significant positive association between:
      - total sitting time (per hour) and high LBP intensity (odds ratio; OR=1.43, 95% CI=1.15-1.77, P=0.01)
      - leisure-time sitting (OR=1.45, 95% CI=1.10-1.91, P=0.01)
      - non-significant trend for occupational sitting time (OR=1.34, 95%CI 0.99-1.82, P=0.06).

Sitting Disease
by the numbers

**Our modern sedentary lifestyles,
both at home and in the workplace,
are costly for us and for our employers.**

Average hours of seated commute
+ average hours of seated homelife = too much sitting!

via juststand.org

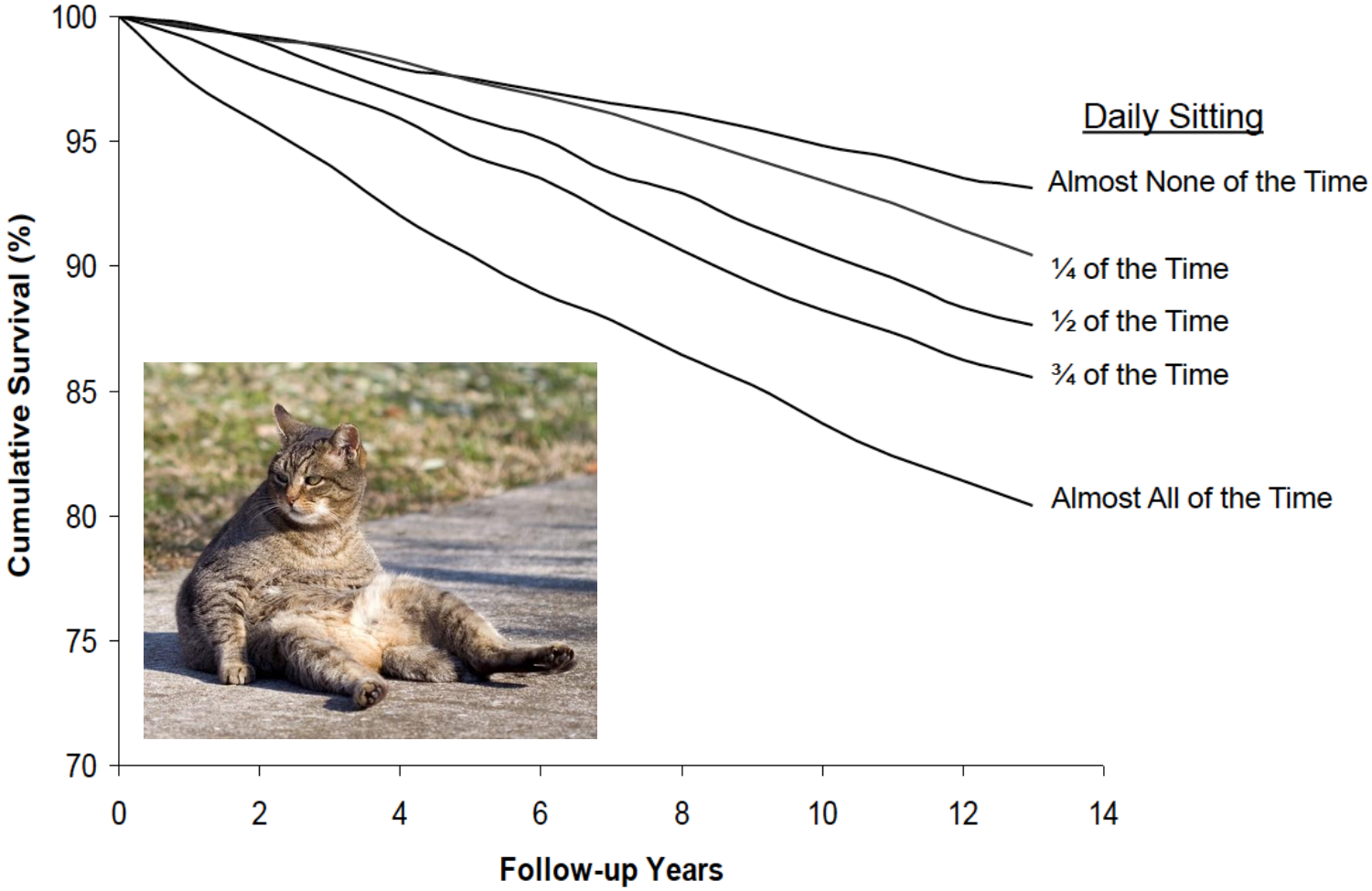
Increased risk of:

- Metabolic syndromes (Gardiner et al. 2011)
- Inflammatory biomarkers (Healy et al. 2011)
- CVD mortality (Dunstan et al. 2010)
- Work Inactivity & Death (Renner v. AT&T)

Sitting Time and Mortality from All Causes, Cardiovascular Disease, and Cancer

PETER T. KATZMARZYK[1], TIMOTHY S. CHURCH[1], CORA L. CRAIG[2], and CLAUDE BOUCHARD[1]

[1]Pennington Biomedical Research Center, Baton Rouge, LA; and [2]Canadian Fitness and Lifestyle Research Institute, Ottawa, Ontario, CANADA



17,013 Canadian Men and Women,
Canada Fitness Survey 12-year Mortality Follow-up, 1981-1993

Med. Sci. Sports Exerc., Vol. 41, No. 5, pp. 998–1005, 2009.

SECTIONS

THERECORDER

Supreme Court Takes Stand on Suitable Seating

Ben Hancock, The Recorder

April 4, 2016 | 2 Comments

SHARE

PRINT

REPRINTS

Justice Carol Corrigan, California Supreme Court

Jason Doiy / The Recorder

SECTIONS

Los Angeles Times

SUBSCRIBE
4 WEEKS FOR 99¢

FRIDAY JUN. 17, 2016

MOST POPULAR LOCAL SPORTS ENTERTAINMENT POLITICS EDUCATION OPINION

LOCAL / L.

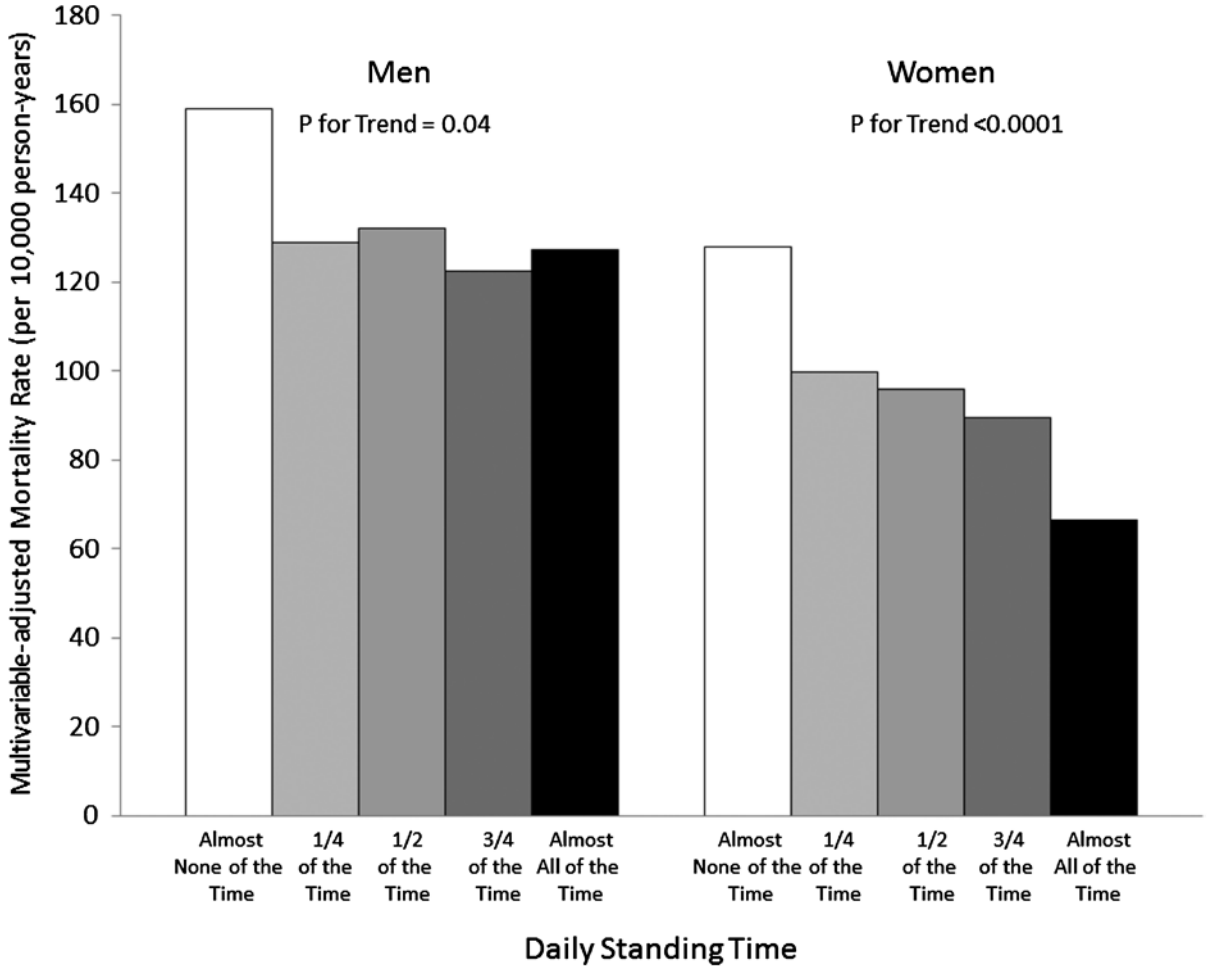
California's top court tells employers to give workers a chair

Workers whose jobs can be done at least partly while sitting should not be forced to stand, the California Supreme Court said Monday. Above, a worker at a Target store. (Jeff Chiu / Associated Press)

In Case You Missed It

Santa Barbara fire bad om
dangerous California fire

DAILY STANDING TIME AND ALL-CAUSE MORTALITY



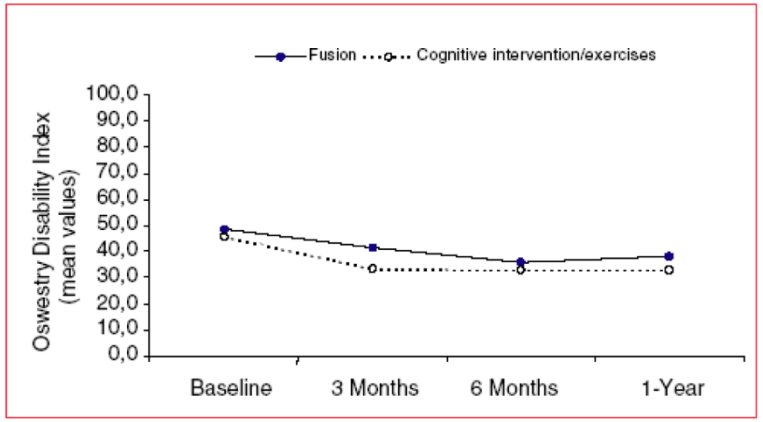
Adjusted for age, smoking, alcohol, LTPA, physical activity readiness

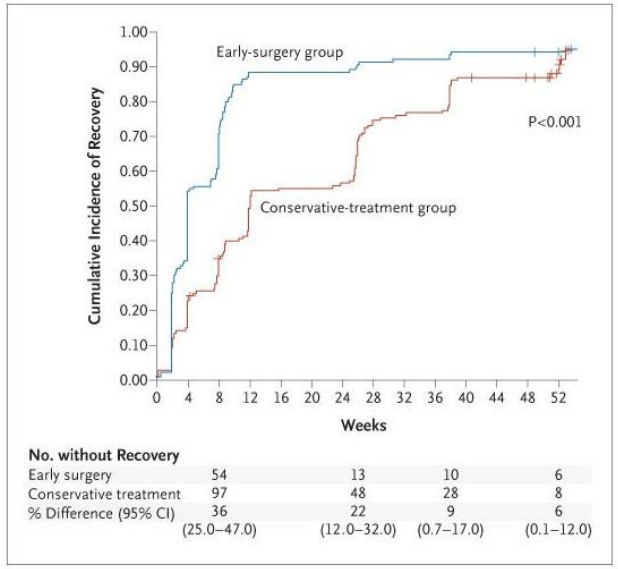
Katzmarzyk (2014)

PREVENTION VS TREATMENT

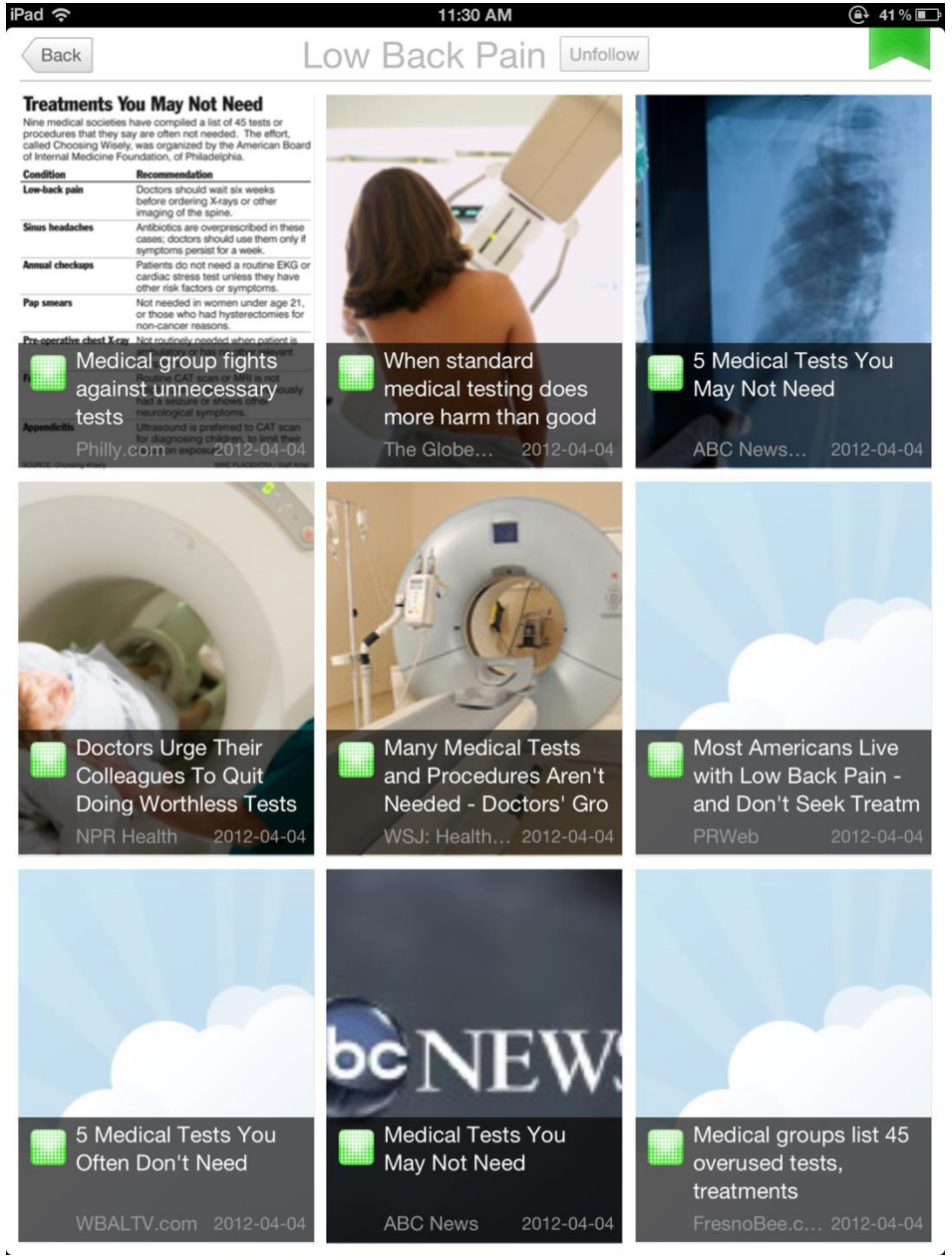
Pain. 2006;122:145-155.

PAIN





N Engl J Med 2007; 356:2245-2256



Government of Canada | Gouvernement du Canada

Canada.ca | Services | Departments | Français

Canadian Centre for Occupational Health and Safety

Canada

Search

Legislation | Hazards | Workers | Health and Wellness | Programs | HELP | LOGIN

I am looking for...

Home → OSH Answers → Working in a Sitting Position

OSH Answers Fact Sheets

Easy-to-read, question-and-answer fact sheets covering a wide range of workplace health and safety topics, from hazards to diseases to ergonomics to workplace promotion. MORE ABOUT >

Search all fact sheets:

SEARCH

Type a word, a phrase, or ask a question

HELP

Overview

CLOSE ALL

- ▸ Why is there so much fuss being made about sitting?
- ▸ Can work in a sitting position affect your health?
- ▸ How does the work in a sitting position affect blood circulation?
- ▾ Can work in a sitting position cause injuries that affect movements?

Limited mobility contributes to injuries in the parts of the body responsible for movement: the muscles, bones, tendons and ligaments. Another factor is the steady, localized tension on certain regions of the body. The neck and lower back are the regions usually most affected. Why? Prolonged sitting:

- reduces body movement making muscles more likely to pull, cramp or strain when stretched suddenly,
- causes fatigue in the back and neck muscles by slowing the blood supply and puts high tension on the spine, especially in the low back or neck, and
- causes a steady compression on the spinal discs that hinders their nutrition and can contribute to their premature degeneration.

UCLA Health

UCLA Spine Center

About Us | Conditions | Treatments | For Patients | Contact Us | Fellowship Programs | For Healthcare Professionals | Physician Directory

For Patients

For Patients

- Appointments
- New Patient Questionnaires
- Choosing a Multidisciplinary Pain Program
- Understanding Neck and Back Pain
- Specialists Who Treat Back Pain
- Physiatrists
- Ergonomics for Prolonged Sitting
- Fitness
- Planning Your Spine Surgery
- Preparing for Surgery
- Patient Stories >
- Frequently Asked Questions
- Health Plans
- Helpful Resources

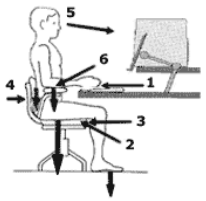
Home > For Patients > Ergonomics for Prolonged Sitting

Ergonomics for Prolonged Sitting

Share this

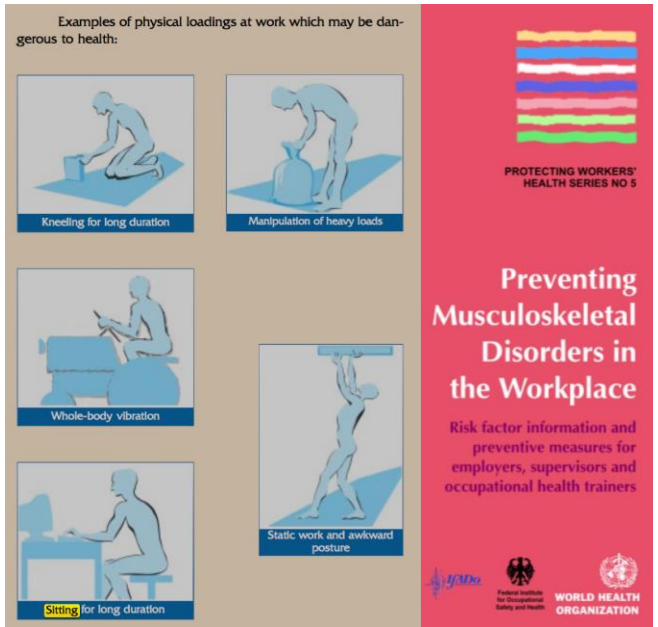
Sitting for prolonged periods of time can be a major cause of back pain, cause increased stress of the back, neck, arms and legs and can add a tremendous amount of pressure to the back muscles and spinal discs. Additionally, sitting in a slouched position can overstretch the spinal ligaments and strain the spinal discs.

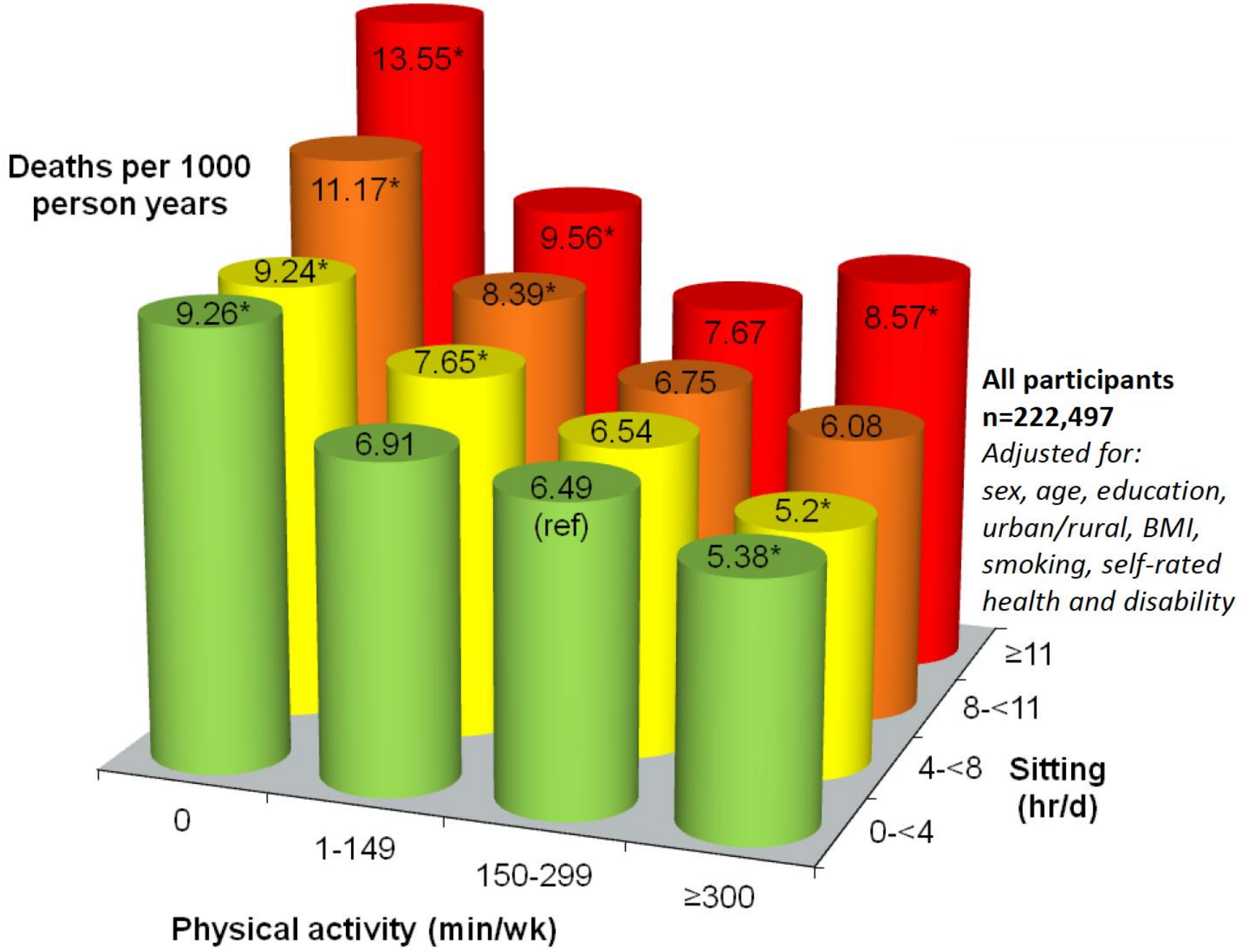
Besides being uncomfortable, poor sitting posture and workplace ergonomics over time can damage spinal structures and contribute to recurrent episodes of neck or back pain.



Here are some important guidelines to help make sure your work area is as comfortable as possible and causes the least amount of stress to your spine:

1. **Elbow measure**
   Begin by sitting comfortably as close as possible to your desk so that your **upper arms are parallel to your spine**. Rest your hands on your work surface (e.g. desktop, computer keyboard). If your elbows are not at a 90-degree angle, move your chair either up or down.





van der Ploeg et al., Arch Intern Med 2012

UK 2011 & AUSTRALIA 2014 PUBLIC HEALTH GUIDELINES

Adults should minimize the time spent being sedentary (sitting) for extended periods.

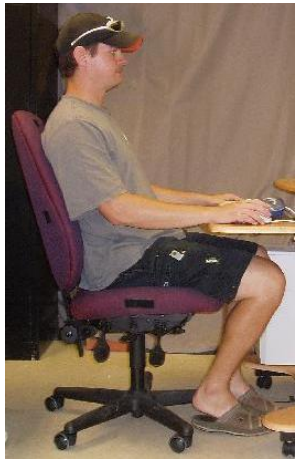
AMA 2013

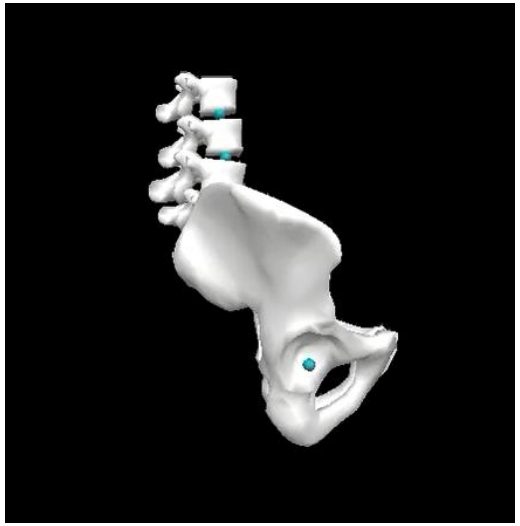
Prolonged sitting, particularly in work settings, can cause health problems. Businesses should offer employees alternatives to sitting all day – such as standing desks, isometric balls instead of desk chairs, or re-arranging office space and work habits to encourage more movement during the day.

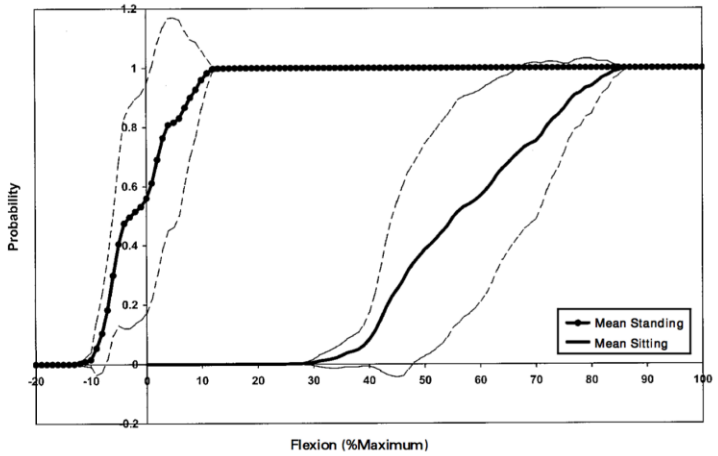
TALK OVERVIEW

- Disclaimer
- Sedentary Work Exposures Background
- **Office Work exposures and best practice**
- Police Cruiser MDT Related Work – where safety and safer conflict
- MSD Resources

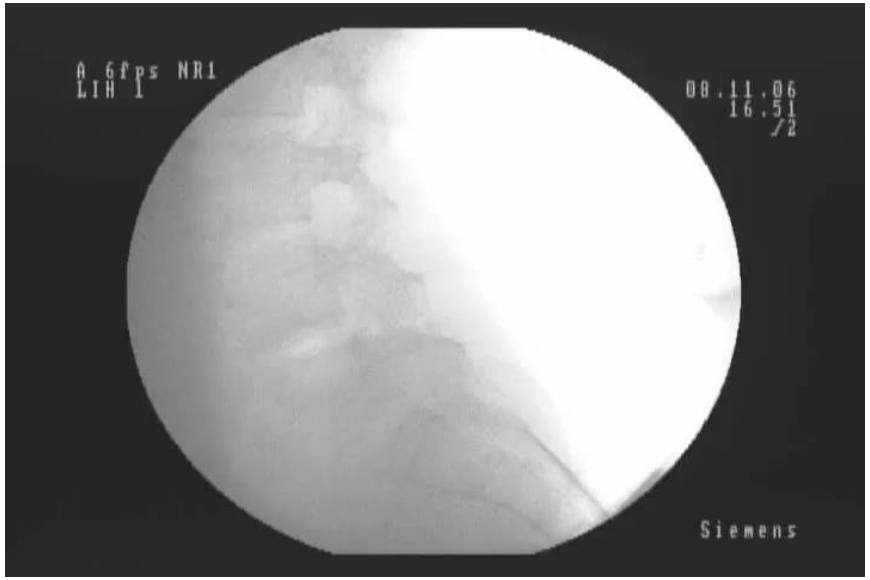
LOW BACK IN SITTING AND STANDING



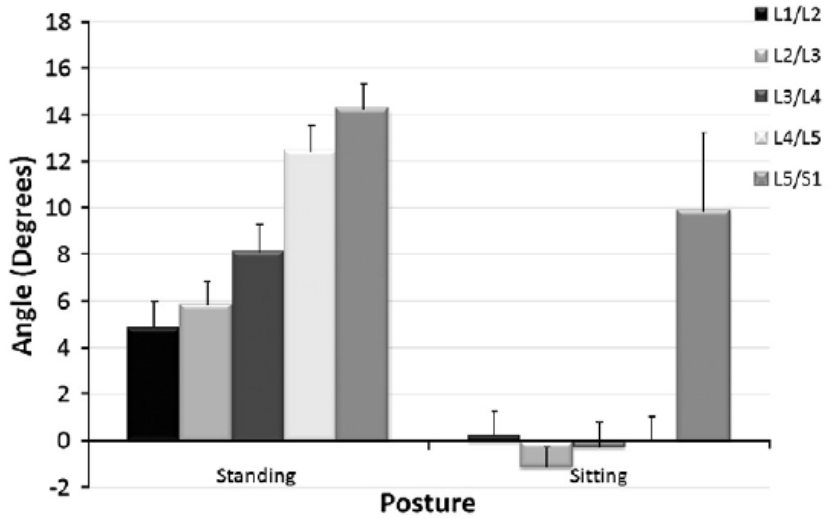




Callaghan & McGill. Ergonomics 2001.



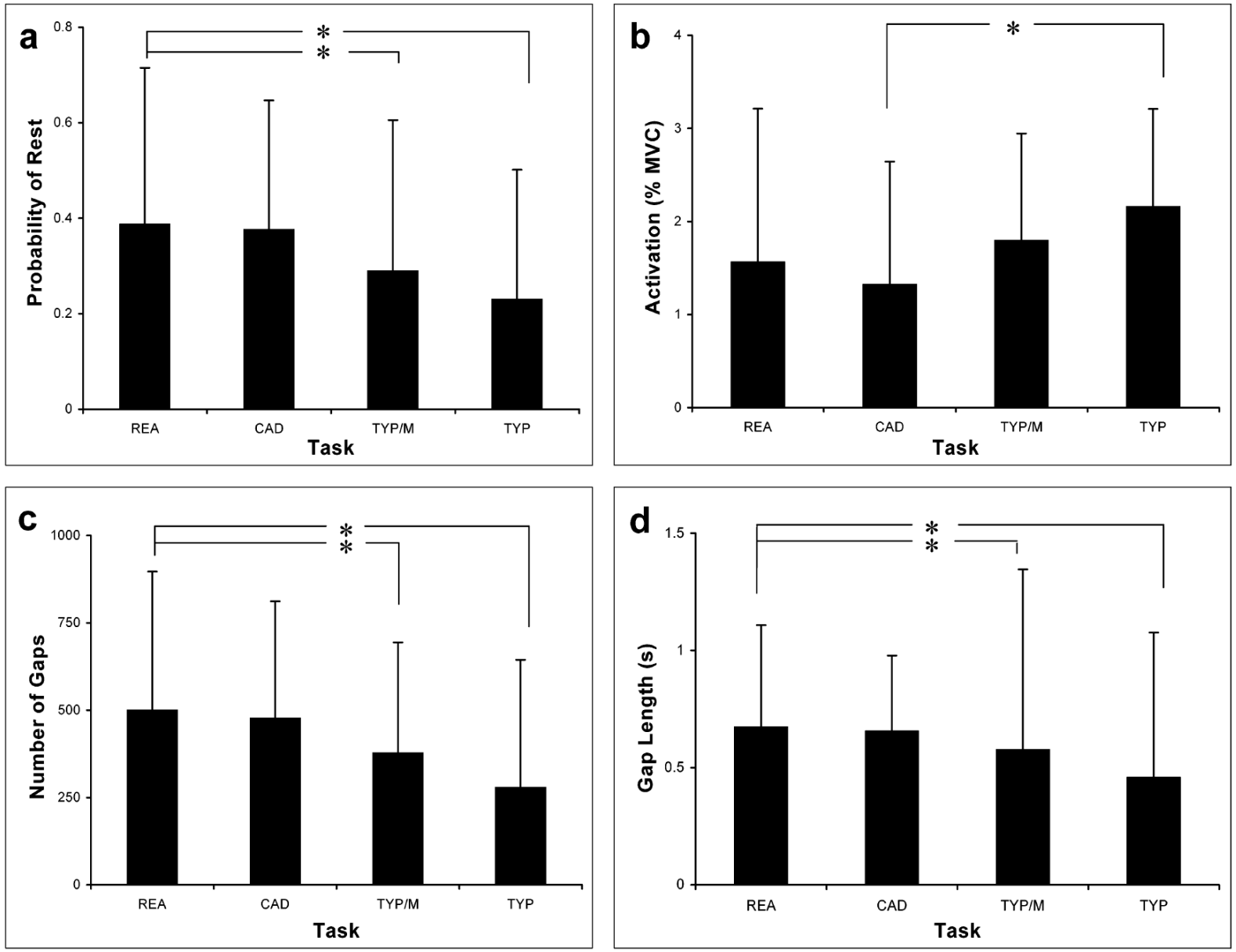
De Carvalho, Soave, Ross, Callaghan/ J Manip Physio Ther/ 33 (2010)



Dunk, Kedgley, Jenkyn, Callaghan/ Clinical Biomechanics/ 24 (2009)

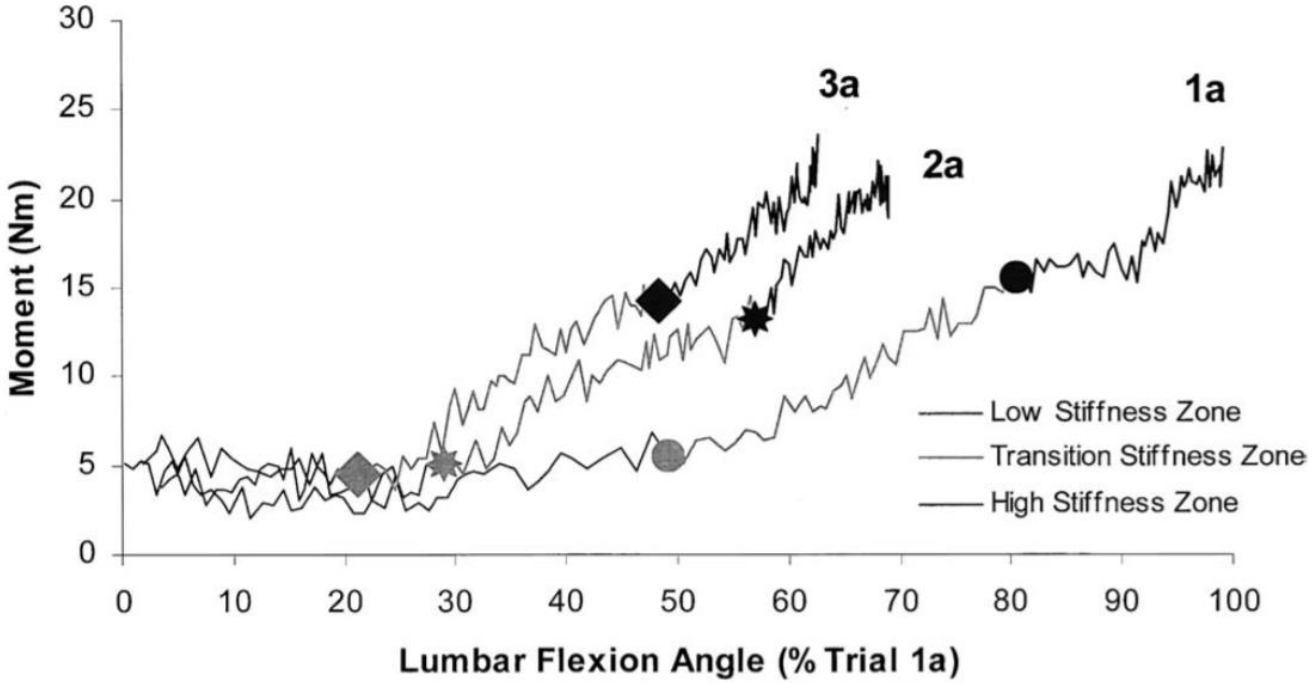
De Carvalho and Callaghan. IJIE 2011.

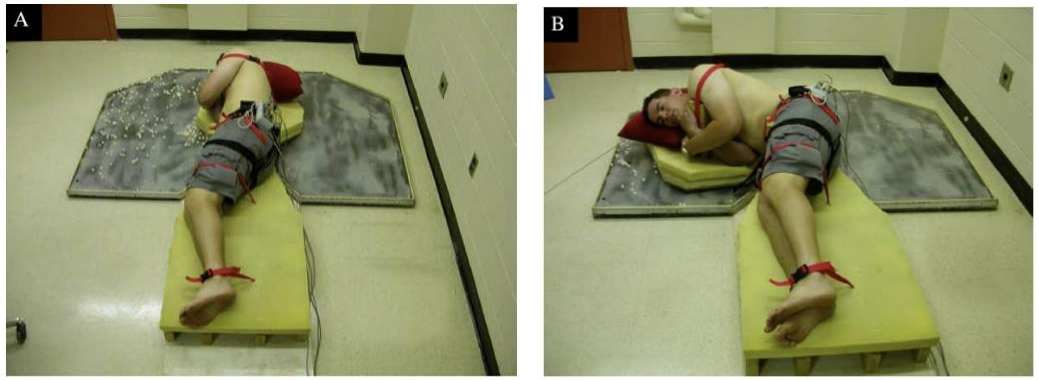
MUSCLE INVOLVEMENT IN SITTING



Gregory, Dunk, Callaghan *Human Factors* (2006).

SPINE TIME-VARYING RESPONSES TO SITTING





Beach, Parkinson, Stothart, & Callaghan *The Spine Journal* 5(2): 145-154, 2005.

Alexander et al. *Spine*, *32*(14), (2007)

Monday → Tuesday → Wednesday → Thursday → Friday → Saturday Sunday

Lab session

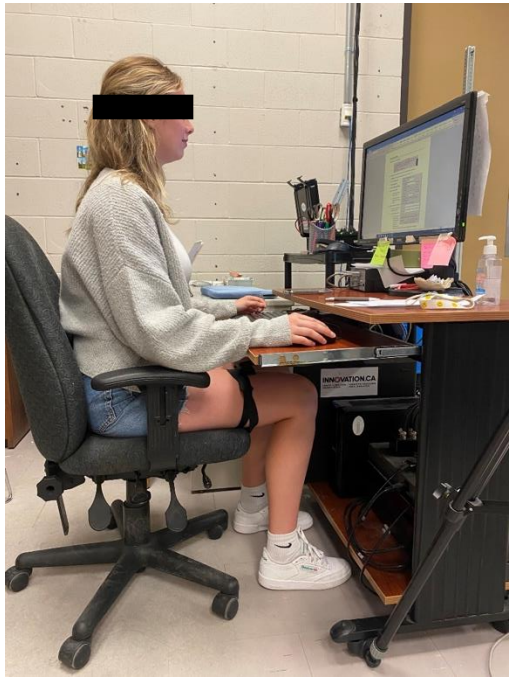
Lab session

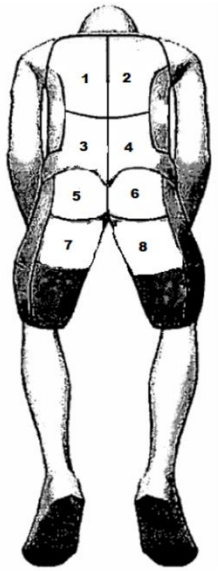
Typical office work

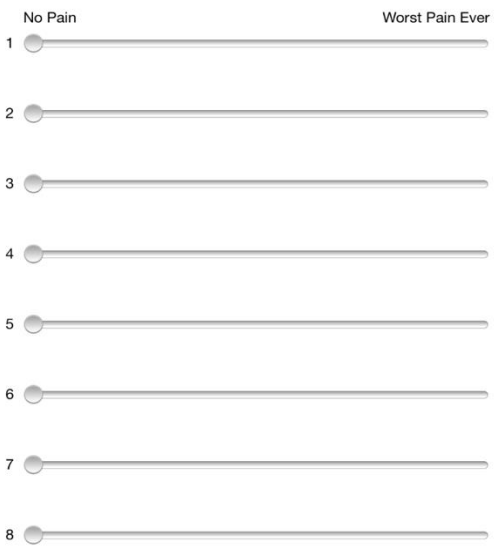
Lab session

Lab session

No activity restrictions





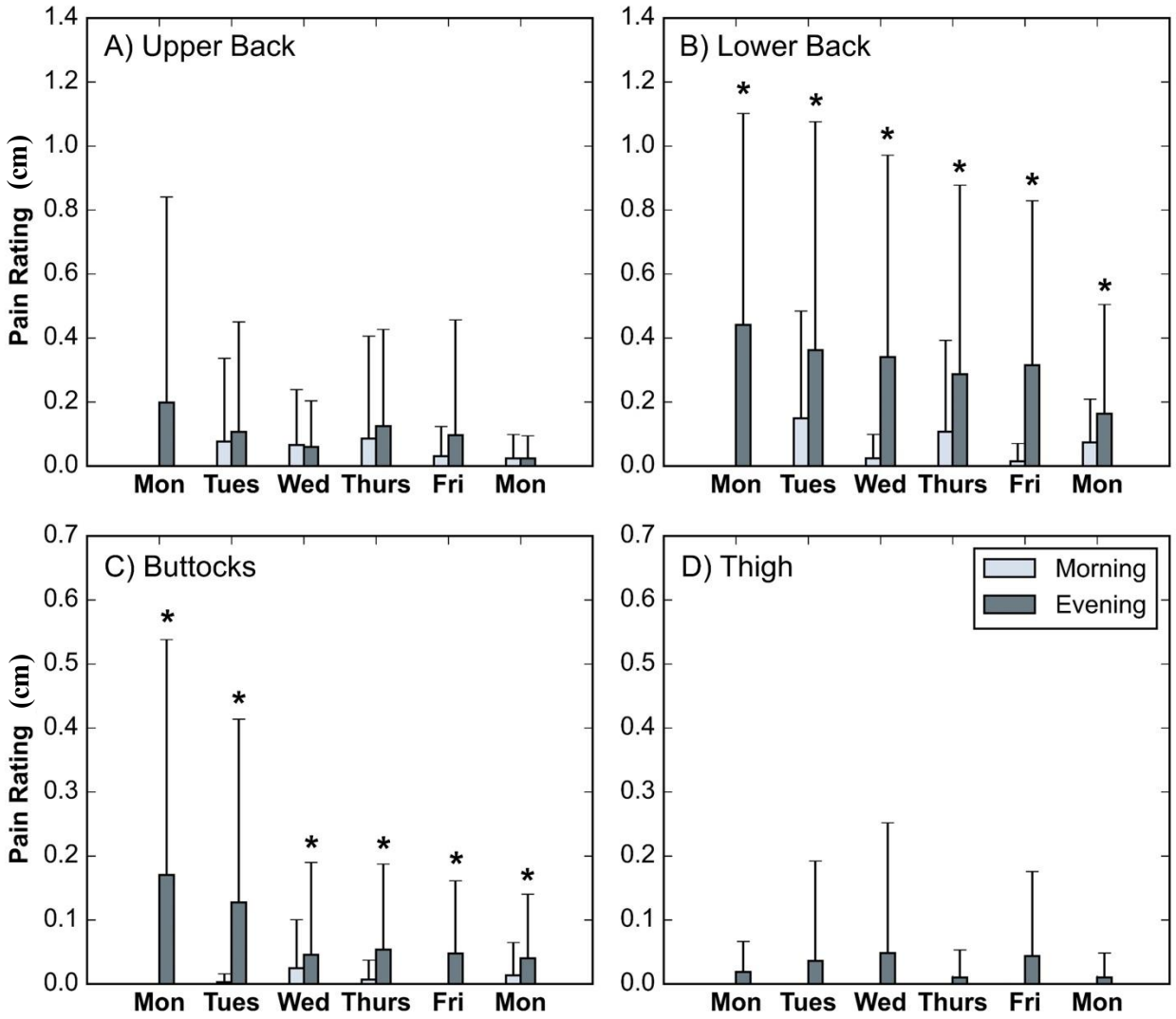


eVAS
Electronic Visual Analog Scale

https://apps.apple.com/ca/app/evas/id6447213570

Davidson & Callaghan *Applied Ergonomic* 122(104374): 1-11, 2024.

PAIN RESPONSES

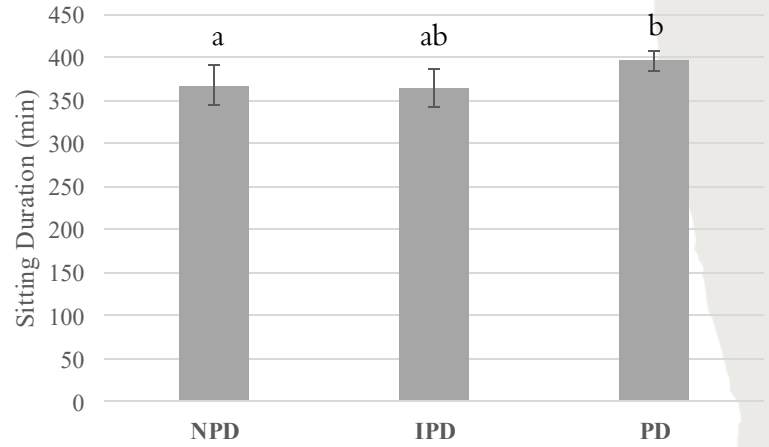


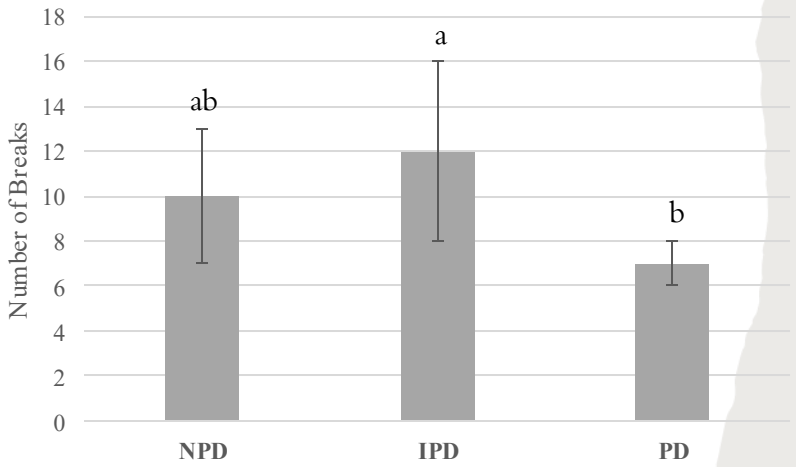
pain significantly higher in evening than morning

Pain Status	Definition	N
Non-pain developers	< 5 mm	10 (5M, 5F)
Intermediate pain developers	5-10 mm	4 (2M, 2F)
Pain developers	> 10 mm	6 (3M, 3F)

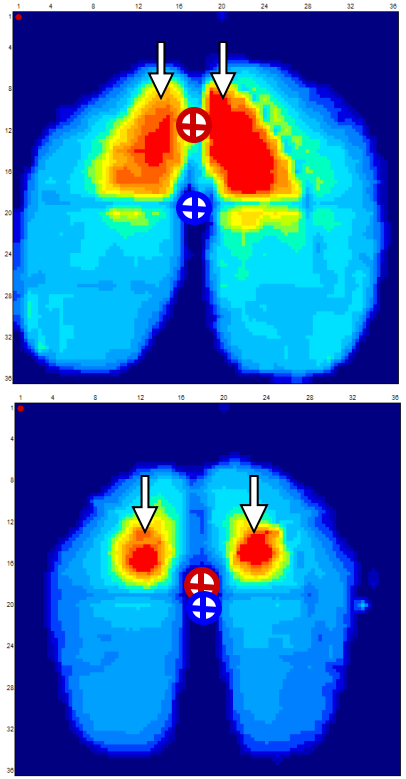
ACTIVITY DIFFERENCES BY PAIN STATUS

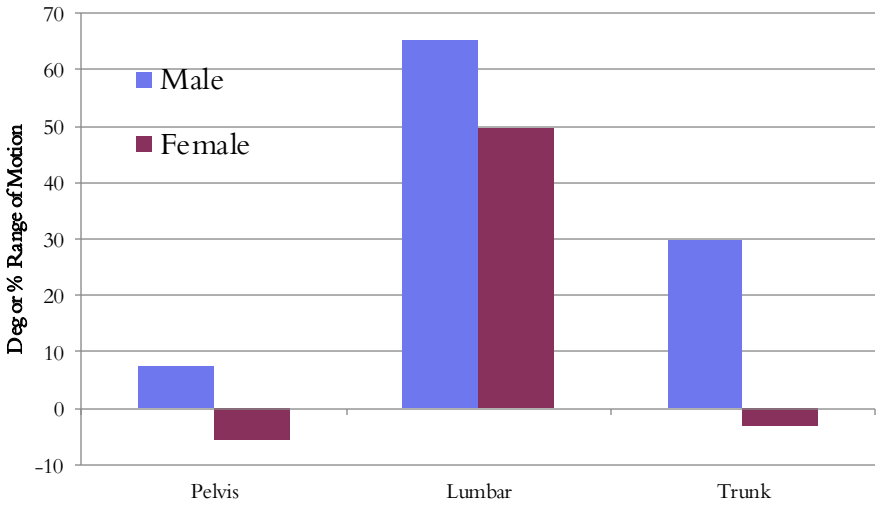
Dependent Variable	Non-Pain Developers	Intermediate Pain Developers	Pain Developers
Sitting Duration			
Total (min)	367 (23)[a]	364 (22)[ab]	396 (12)[b]
Total (%)*	87 (5)[a]	86 (5)[b]	93 (2)[c]
Maximum (min)	110 (29)	101 (32)	110 (14)
Average (min)	35 (9)	27 (16)	38 (11)
Number of Bouts	13 (3)	17 (8)	12 (4)
Standing/Stepping Duration			
Total (min)	38 (20)	40 (14)	18 (7)
Total (%)	9 (5)	9 (3)	4 (2)
Maximum (min)	13 (8)	11 (5)	6 (2)
Average (min)	4 (1)	3 (1)	2 (1)
Number of Bouts*	10 (3)[ab]	12 (4)[a]	7 (1)[b]





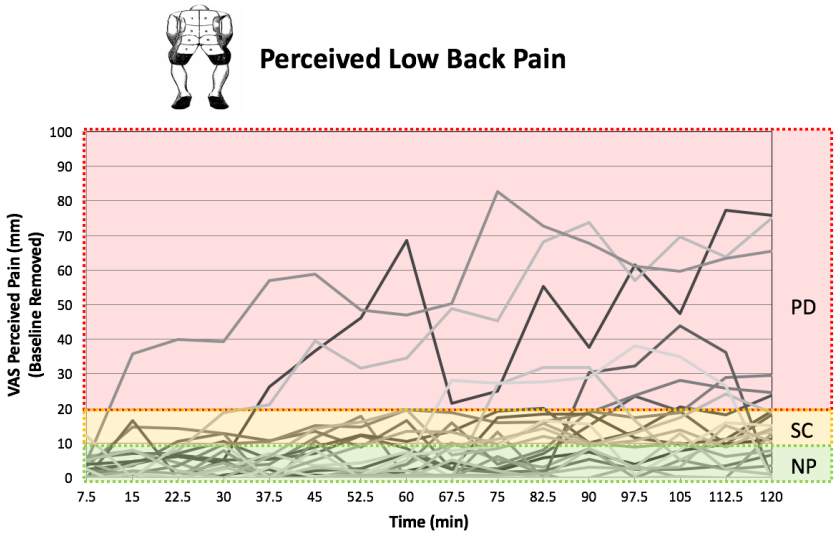
SEX DIFFERENCES

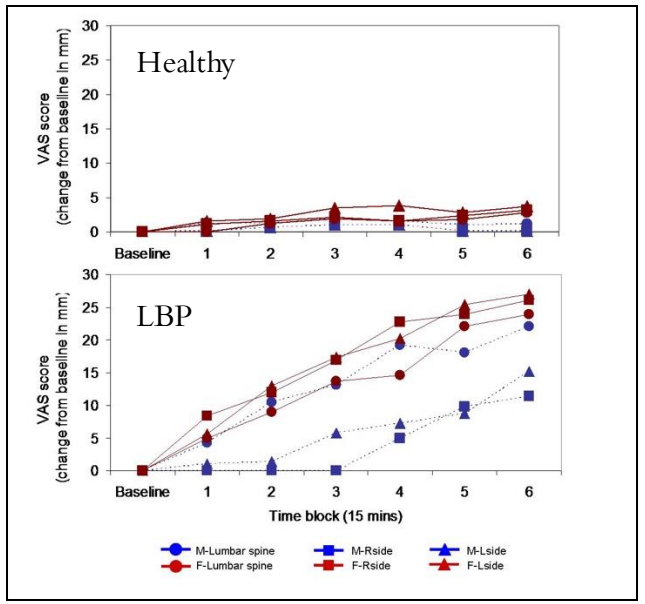


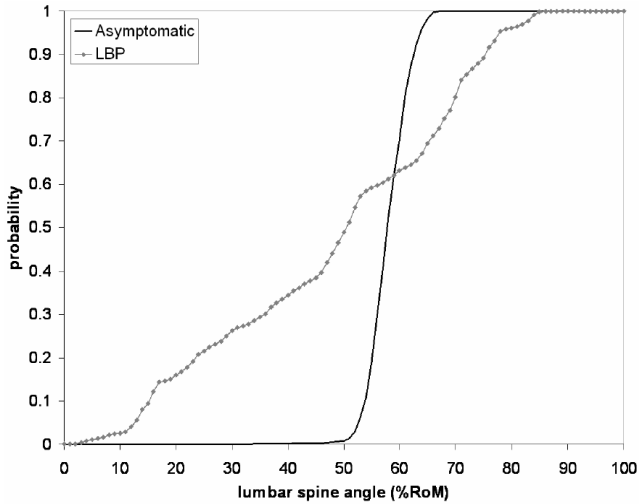


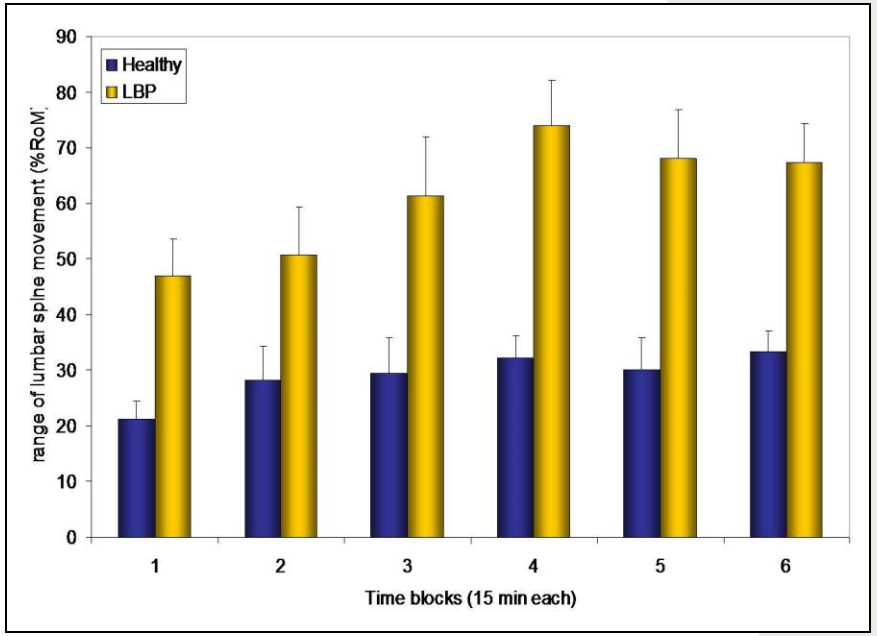
Measurement		Male	Female
% max flexion	Thoracic	8.6	3.1
	Lumbar	65.4	49.6
	Trunk (C7-L5)	29.8	-3.3
Deviation from vertical (degrees)	Pelvis	7.6° (post)	-5.5° (ant)

LBP AND SITTING







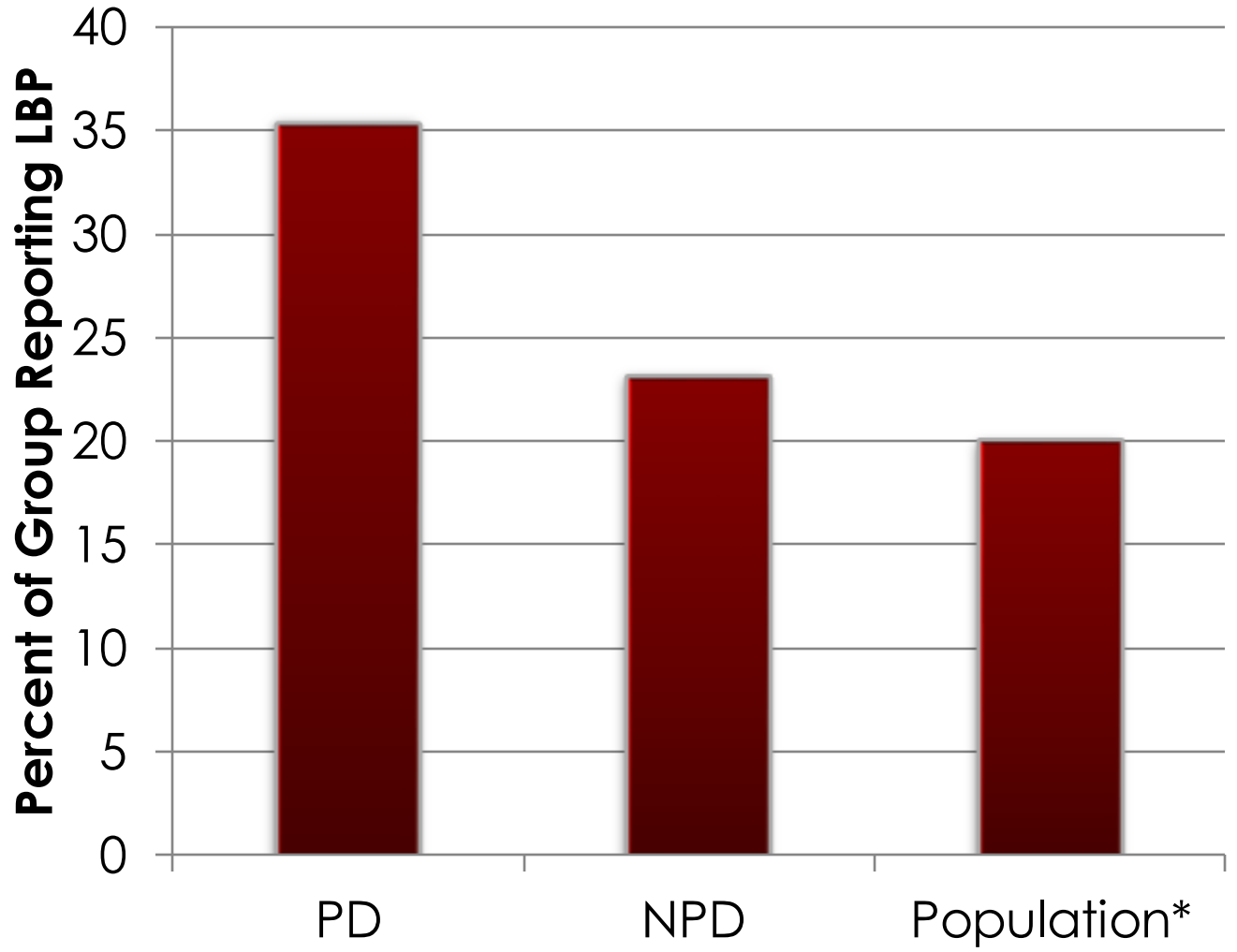


Range of lumbar spine movement over 90 minutes of sitting. LBP sufferers had greater range of movement (P = 0.0002)

Carvalho & Callaghan, International Journal of Industrial Ergonomics 41, 617–624 (2011).

Dunk & Callaghan/ Work/ 35 (2010)

Is it Important? *Longitudinal*

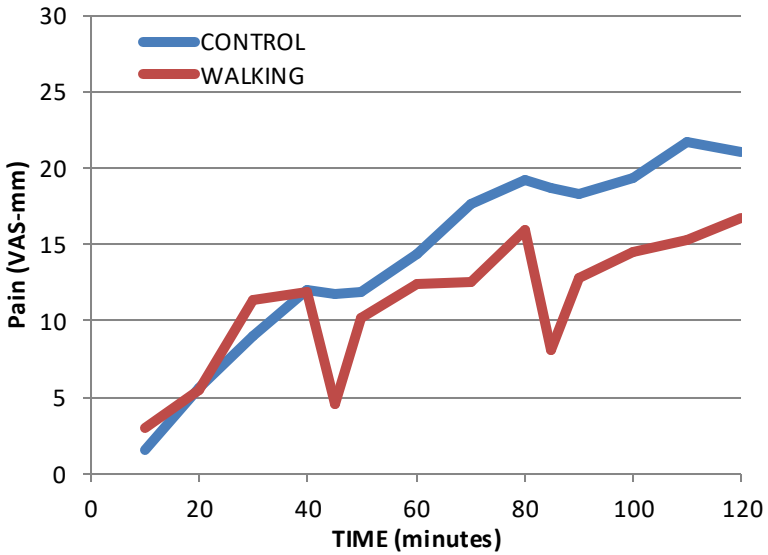


OR > 3

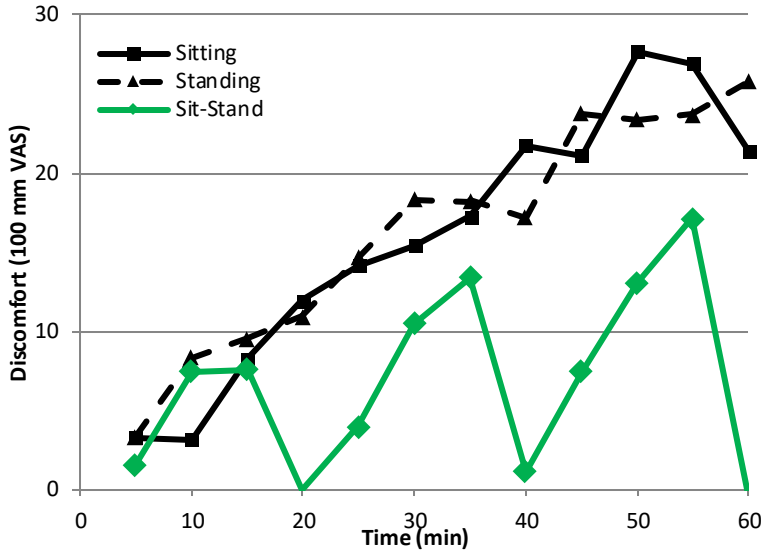
Nelson-Wong & Callaghan, Spine (2014)

**Kolb et al., Spine (2011)*

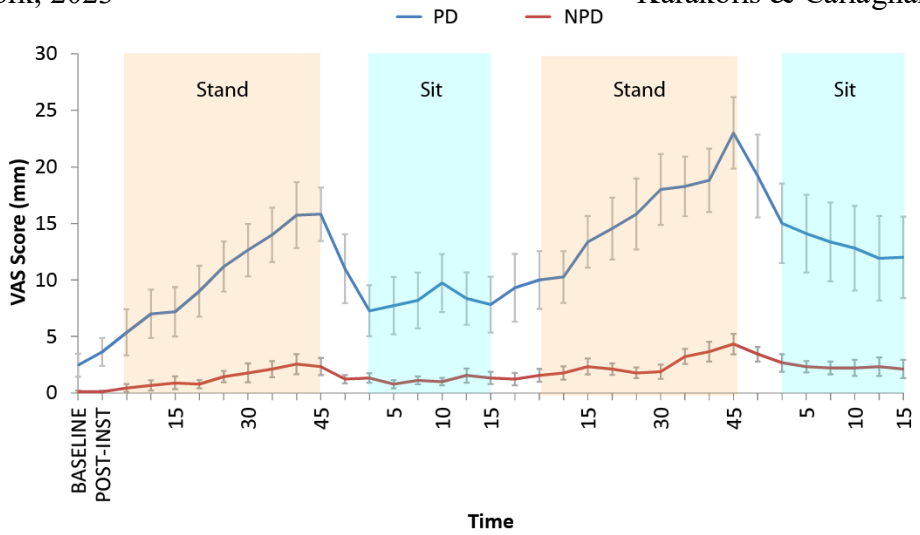
Can We Reset Sitting Pain with Breaks



Carvalho & Callaghan Work, 2023

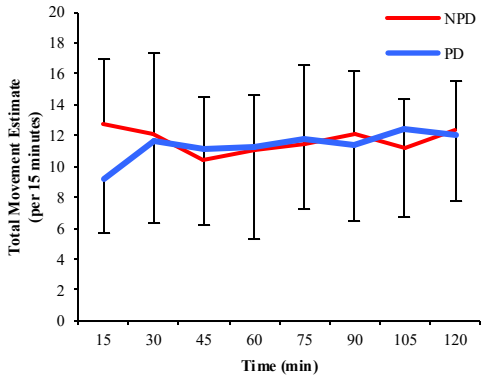


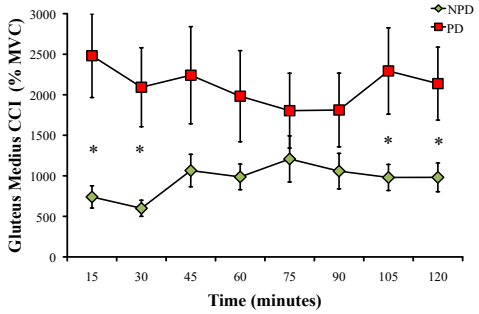
Karakolis & Callaghan, *Ergonomics,* 2016

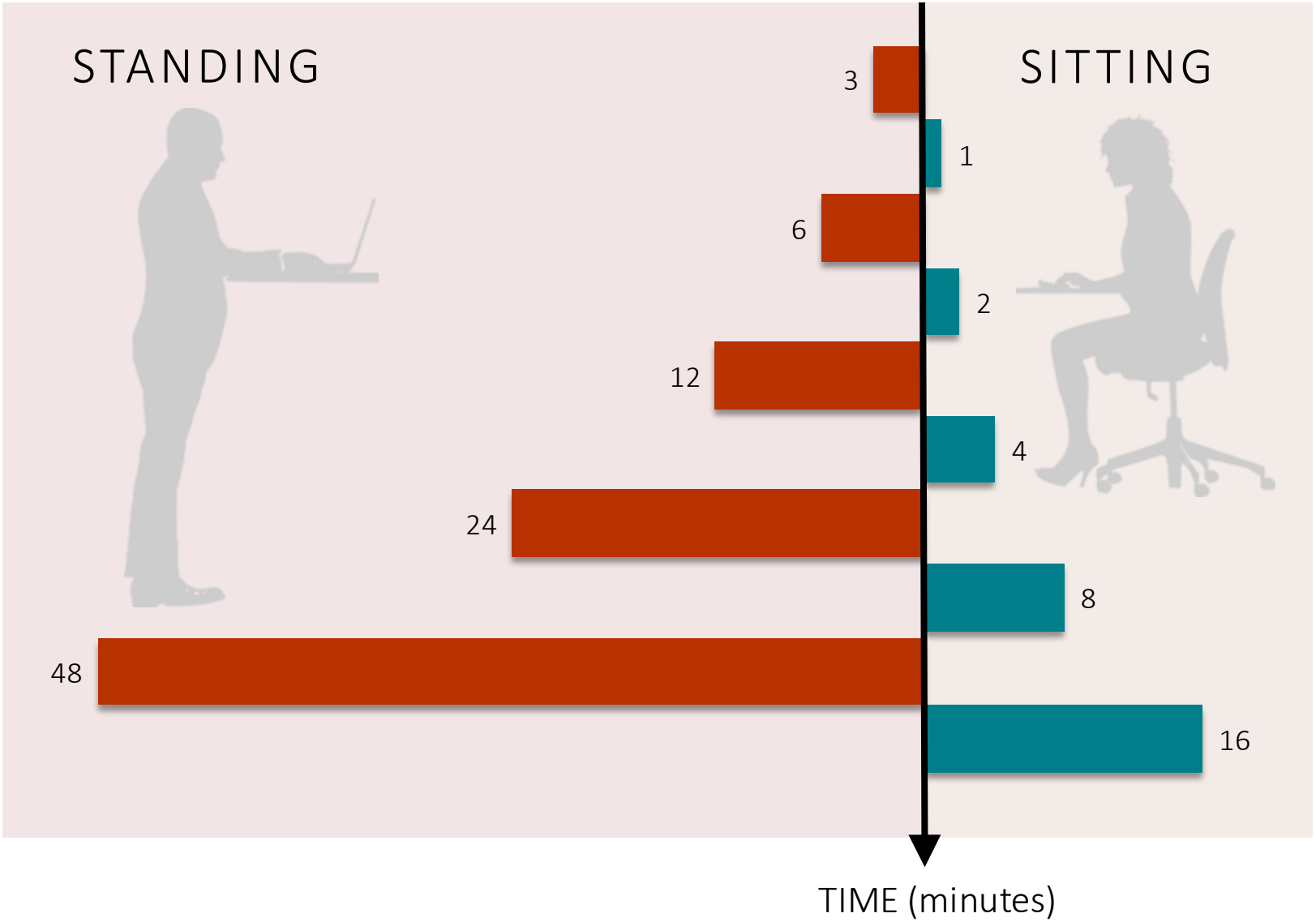


Gallagher & Callaghan, *Ergonomics* 2014

PROGRESSIVE EXPOSURE MODEL



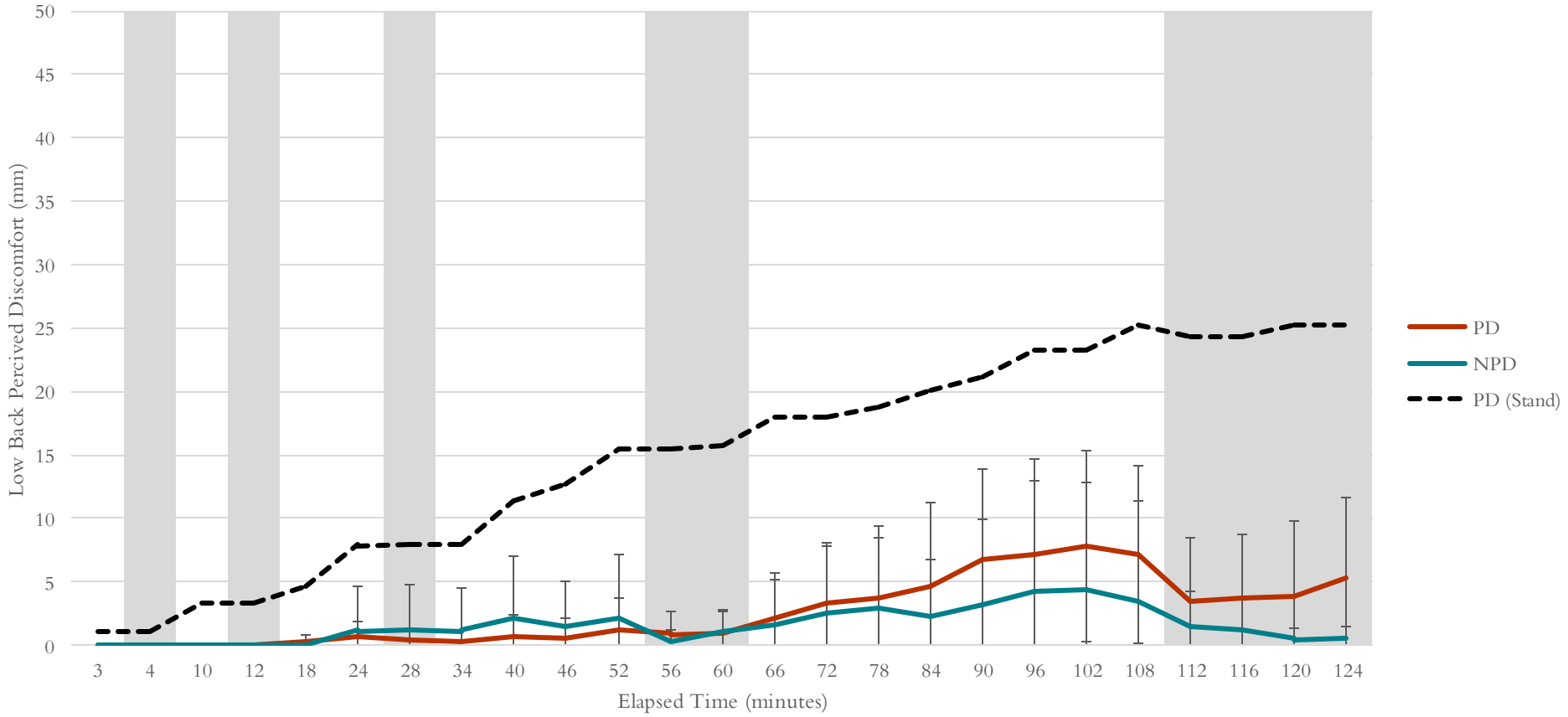




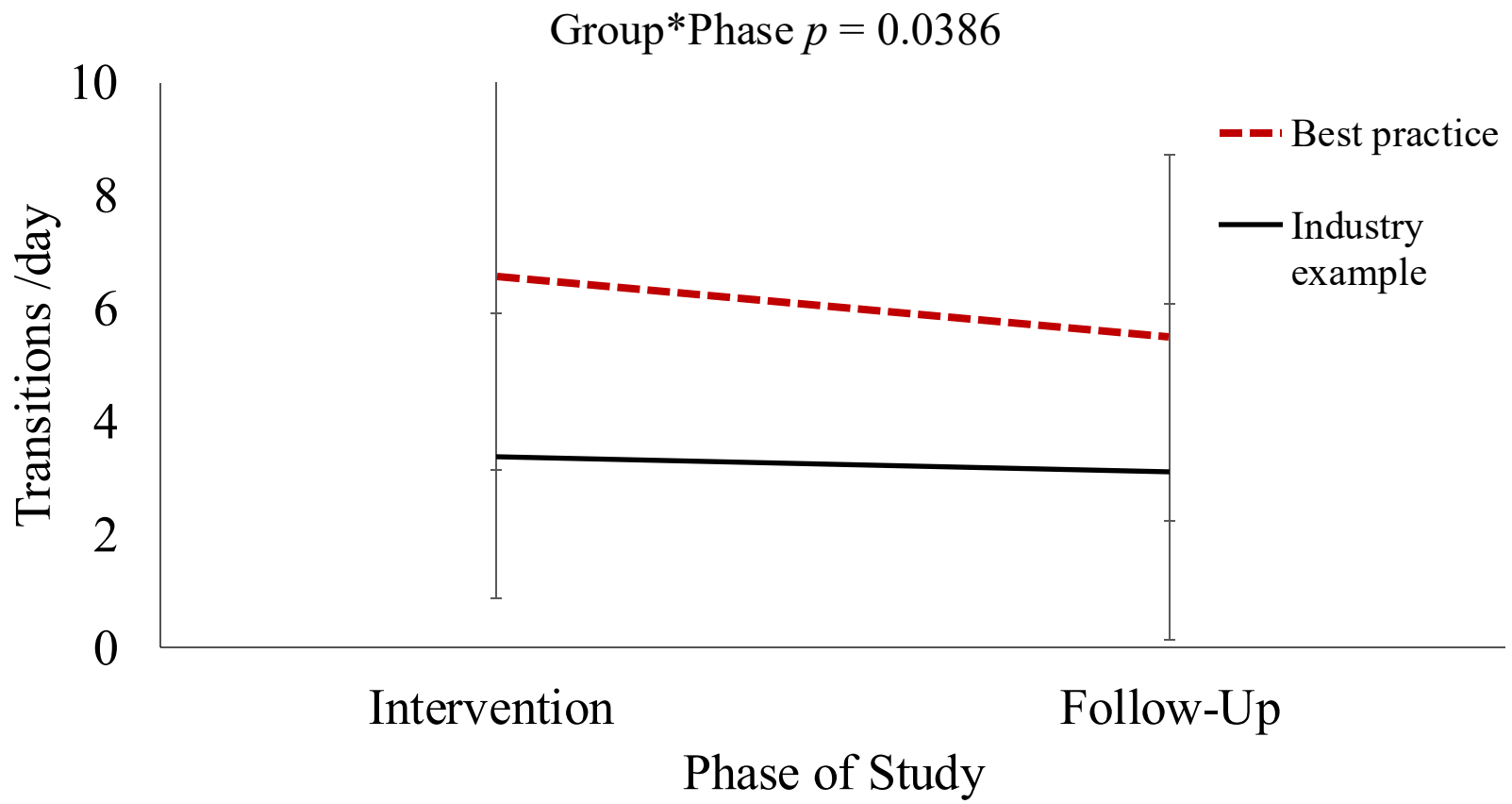
McKinnon, Martel, Callaghan, Ergonomics 2021

LOW BACK PAIN RESPONSE

- Pain group-by-time

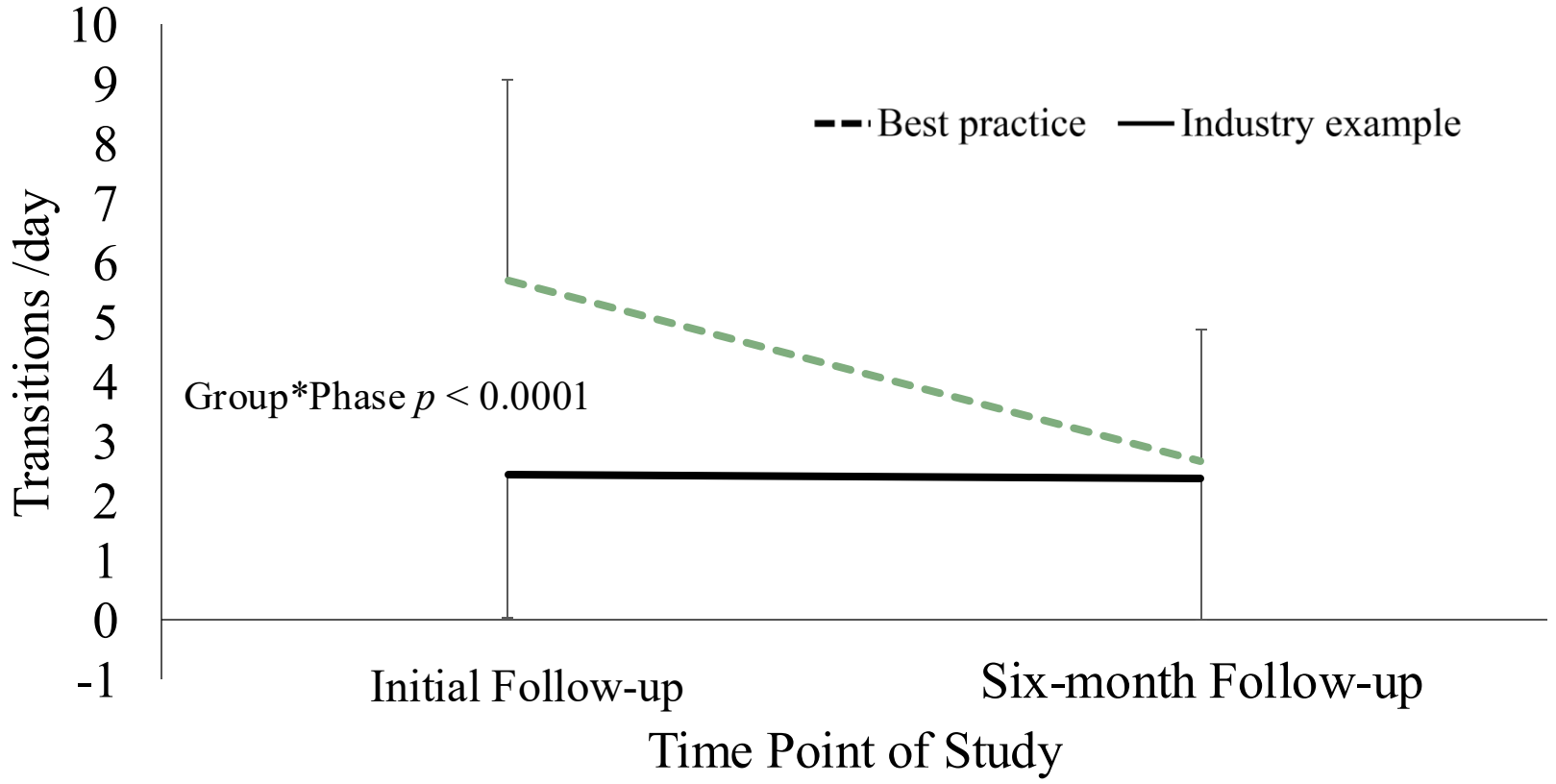


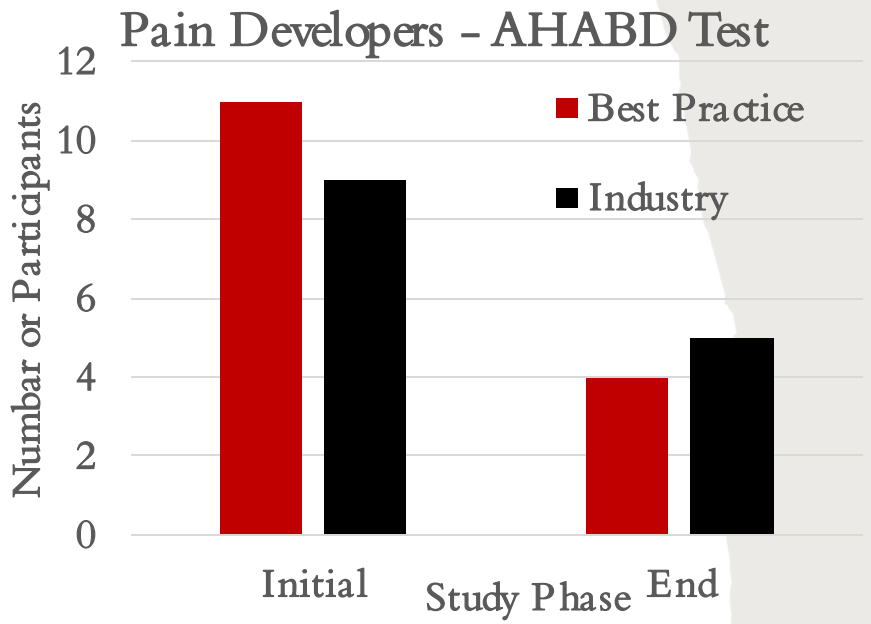
SIT-STAND TRANSITIONS/DAY



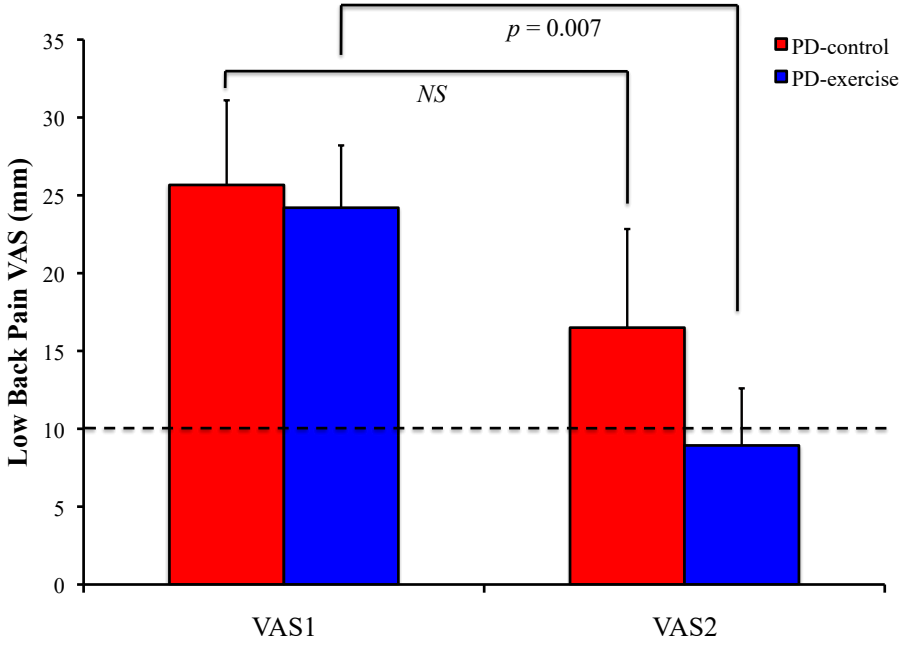
Riddell & Callaghan *Ergonomics* 64(5): 582-592, 2021.

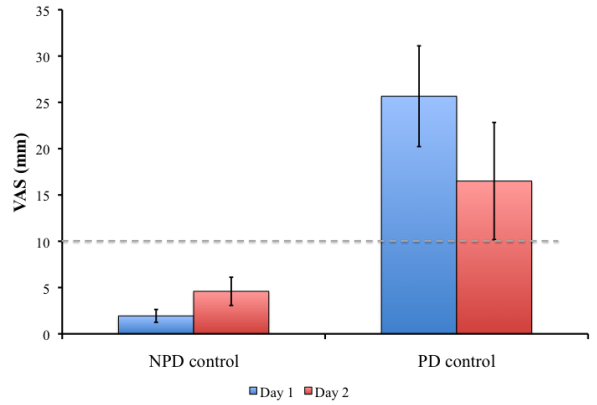
TRANSITIONS: SIX MONTH FOLLOW-UP





Response to Exercise Intervention





Nelson-Wong & Callaghan J EMG & Kin 20 (2010) 1125-33

ERGONOMIC GUIDELINES

OHSCO's Musculoskeletal Disorders Prevention Series
Parts 3A&B: MSD Prevention Toolbox

Fixed Posture	• sitting for long periods without standing (office work, driving, etc.)	☐
	• standing still on a hard surface for a long period of time	☐

STATIC WHOLE BODY POSTURES		CHECK (☑) HERE IF REQUIRED AT THIS JOB/ TASK	NOTES
PROLONGED SITTING	• Worker sits for more than six hours total per day	☐	
PROLONGED STANDING	• Worker stands on a hard surface for more than four hours total per day (standing in one location without taking more than two steps in any direction)	☐	

?

Lifts Less than 6 hours	Lifts more than 6 hours

TAKE HOME MESSAGES

1) Standing and Sitting? in constrained conditions can accelerate LBP for some individuals ≈50%

2) Individual risk factors are important when evaluating LBP in sedentary tasks:

   Predisposing MC strategies separated PD from NPD

   Less RoM, different internal spine postures and Initial movements, Sex differences

3) Once Pain has initiated it is residual or cumulative

4) Exercise can alter individuals predisposed to LBP in sedentary exposures

5) Strategies to induce movement early? *Move Early Move Often*

6) Weekly responses:

- Pain was higher in the evenings than mornings
- Pain status linked to sitting time, the number of standing/walking breaks, and posture
- Between day pain status (within a person) was linked to movement

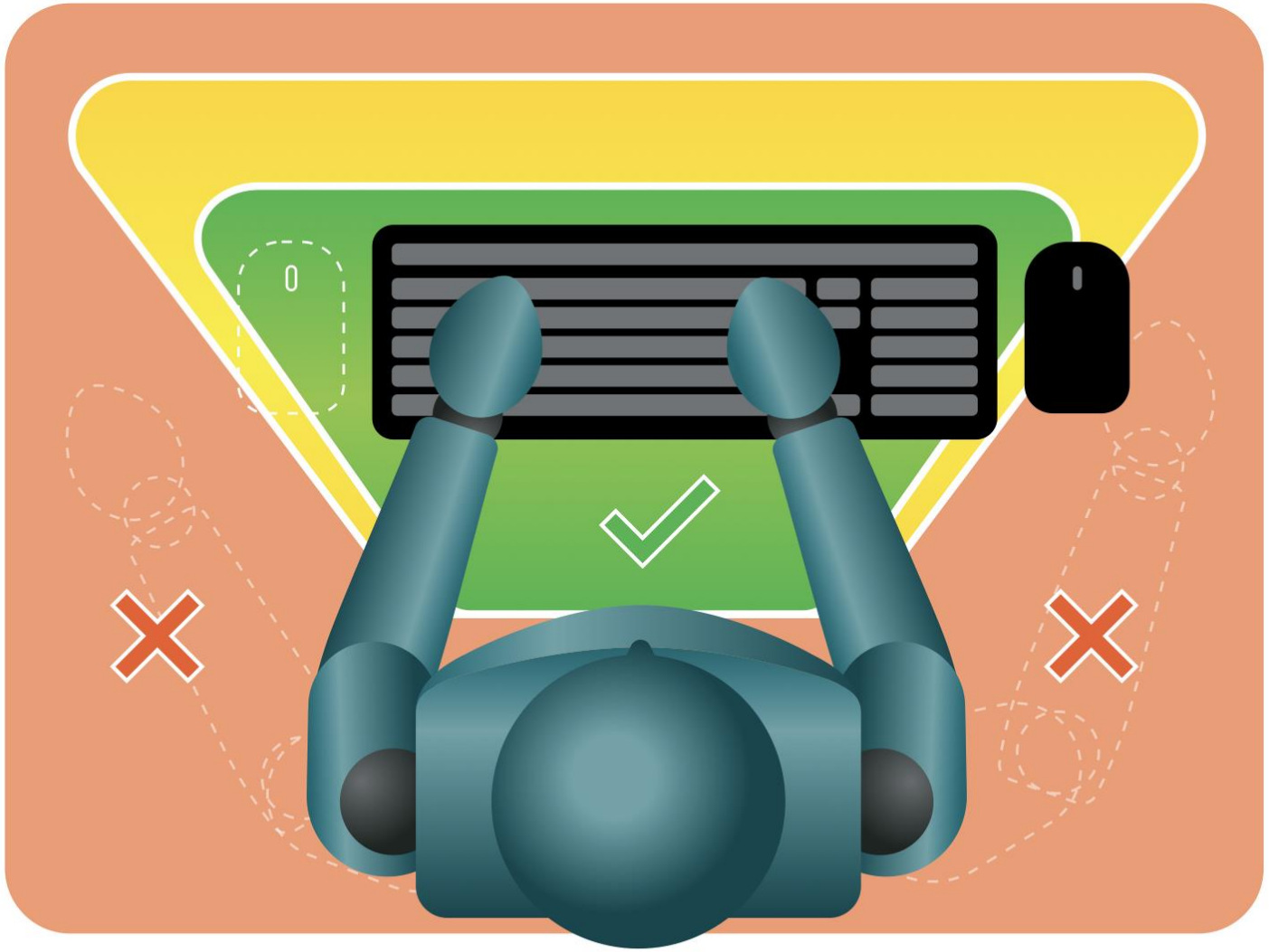
Quick Start Guideline: Office

This office guideline is intended for computer-based work. For more information, please refer to the companion document: Quick Start Guideline: General, for any type of workplace.

Quick Start Guide Office: Folder

The PDF creates a folder that can hold the mini-posters and gives information about MSD and Prevention and how to use the mini-posters. The folder and mini-posters together are a self-contained resource.

View the folder



Reach: Keep it close

- Set up the workspace with frequently used equipment conveniently close to your body.
- Keep frequently used equipment within a forearms distance.
- Long reaches to equipment can increase fatigue and discomfort.
- Avoid reaches outside shoulder width when using your mouse.
- When working away from the workstation, reaching down to floor level and lifting below knee height and above shoulder height can overload the back and shoulders.

MSD PREVENTION GUIDELINE FOR ONTARIO

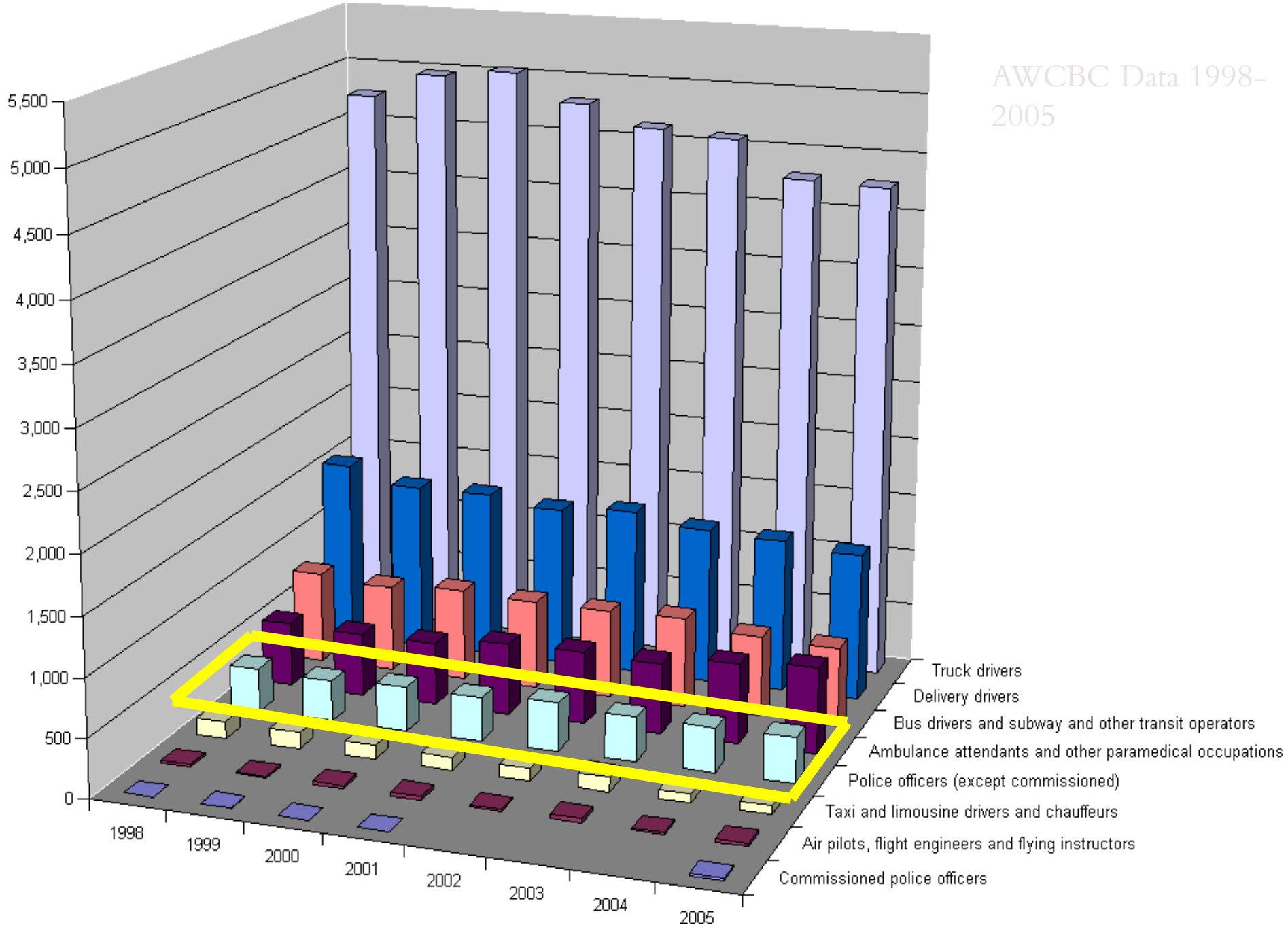
CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

TALK OVERVIEW

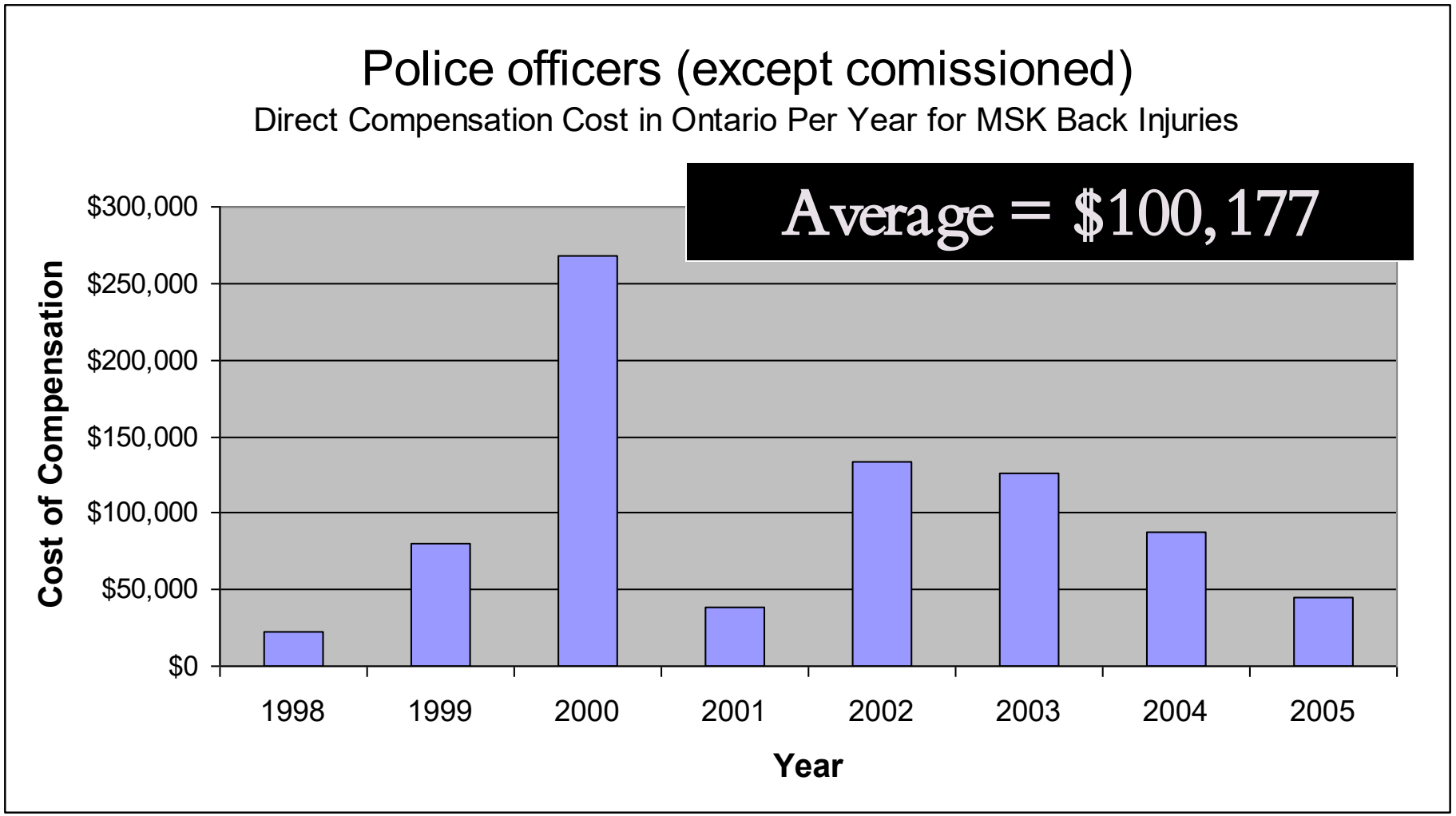
- Disclaimer
- Sedentary Work Exposures Background
- Office Work exposures and best practice
- **Police Cruiser MDT Related Work – where safety and safer conflict**
- MSD Resources

Number of Accepted Claims for Lost Work due to Back Injury

AWCBC Data 1998-2005

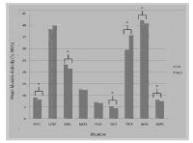


2024 WSIB MSK/MSD Average Claim cost is $7,403

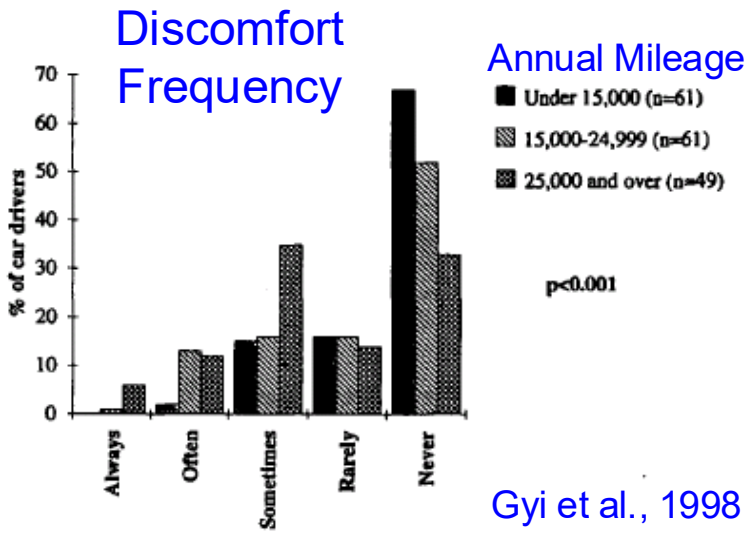


WSIB Data 1998-2005

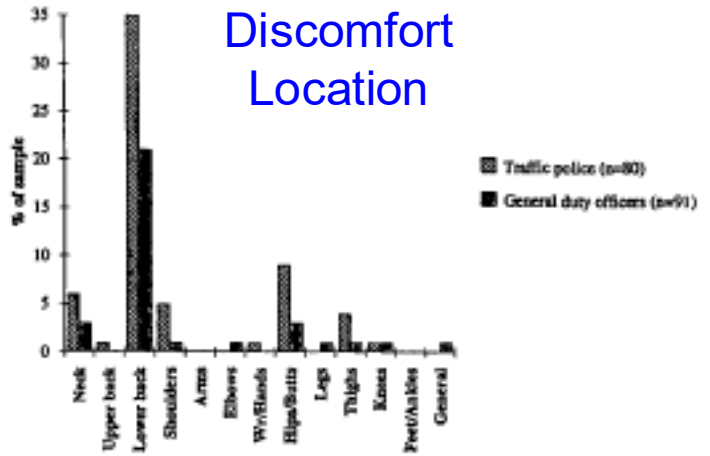
Police Occupational Driving



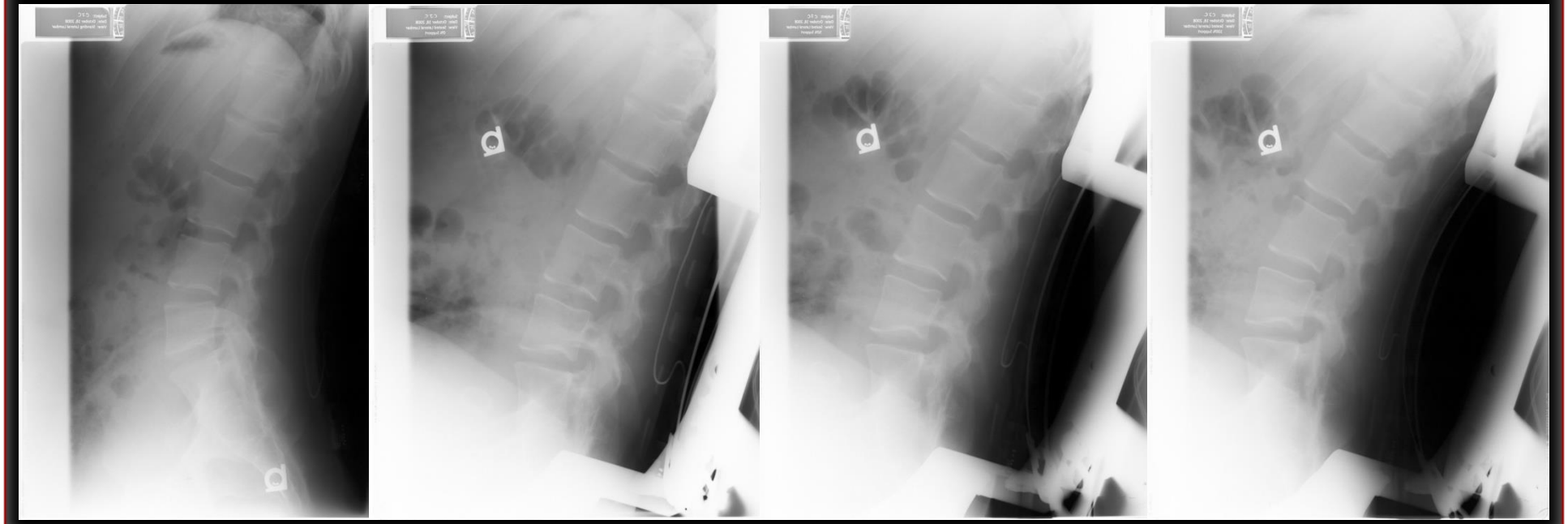
- Occupational Driving
  - Risk 2-3X prolonged sitting alone [Kelsey & Hardy, 1975]
- Police officers (particularly traffic) have a large driving work component
- Musculoskeletal complaints increase with annual driving mileage
- Complaints are regional – low back, hips/butts, shoulder & neck
- LBP - 66% of occupational drivers [Porter, Porter & Lee, 1992]

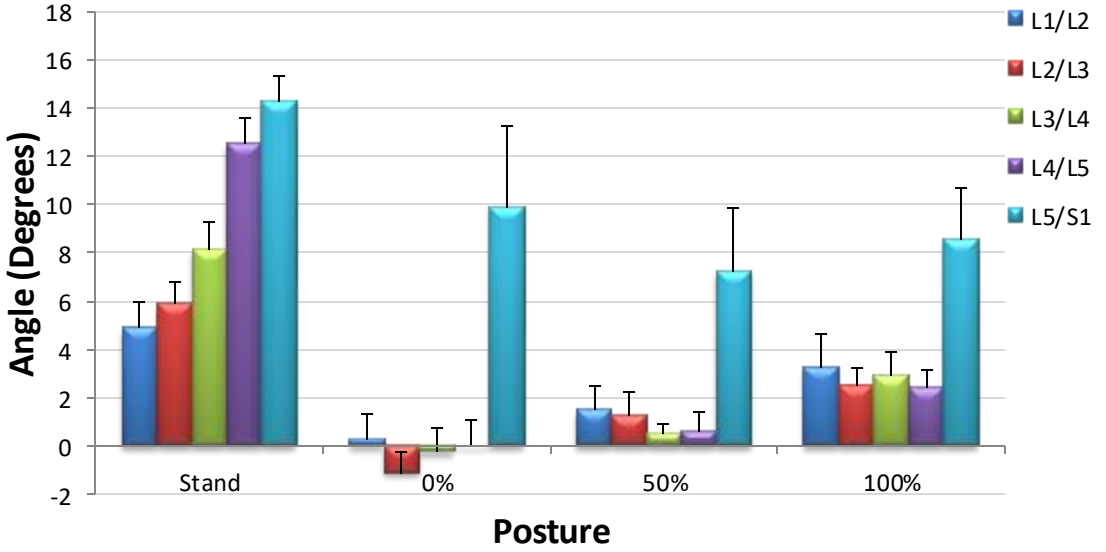


Gyi et al., 1998



Lumbar Posture in Automotive Seats



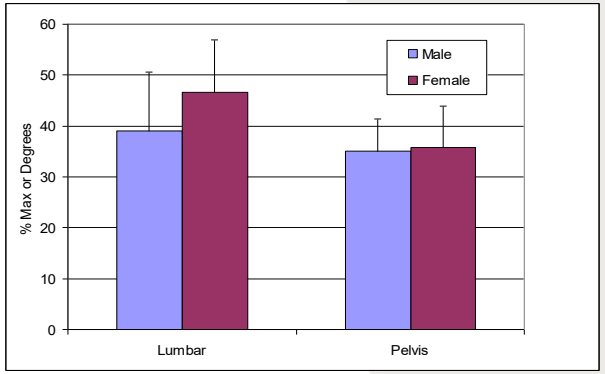


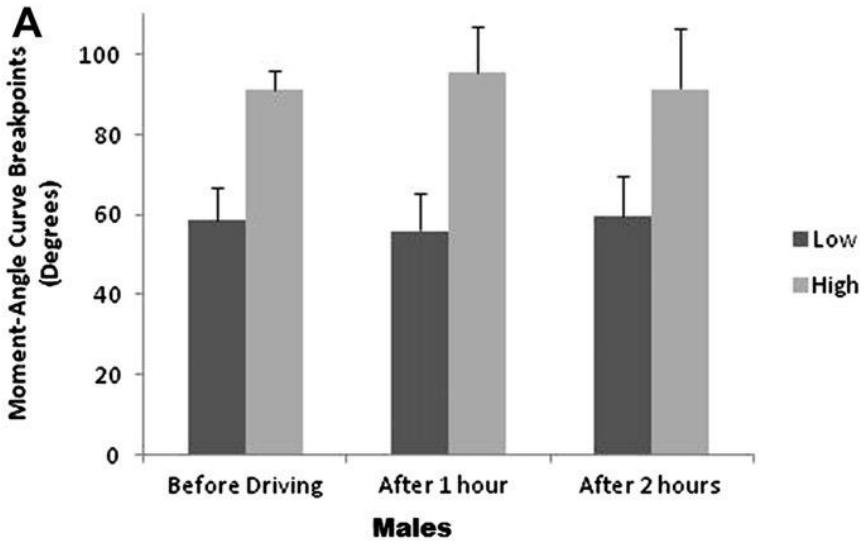
Dunk, Kedgley, Jenkyn, Callaghan/ Clinical Biomechanics/ 24 (2009)

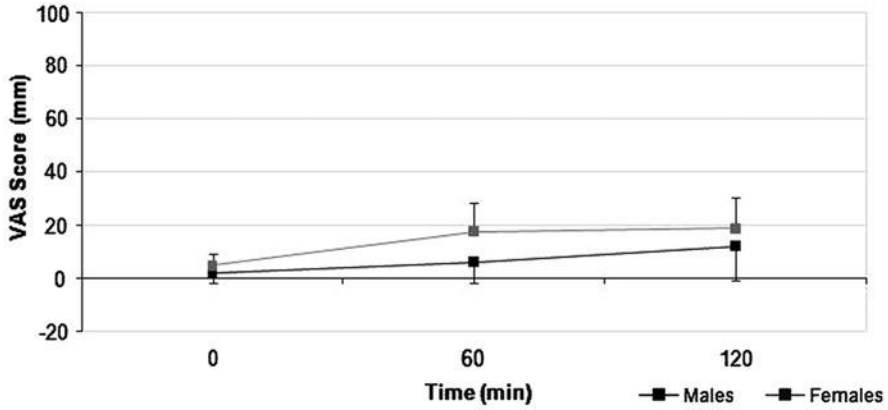
De Carvalho, Soave, Ross, Callaghan/ J Manip Physio Ther/ 33 (2010)

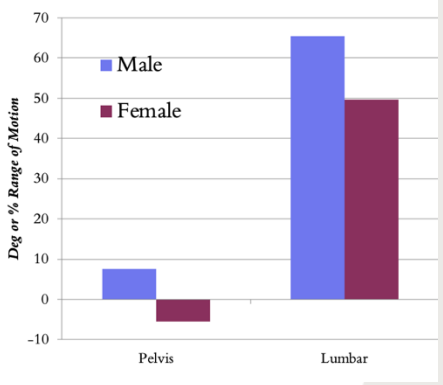
De Carvalho and Callaghan. The International Journal of Industrial Ergonomics 2011.

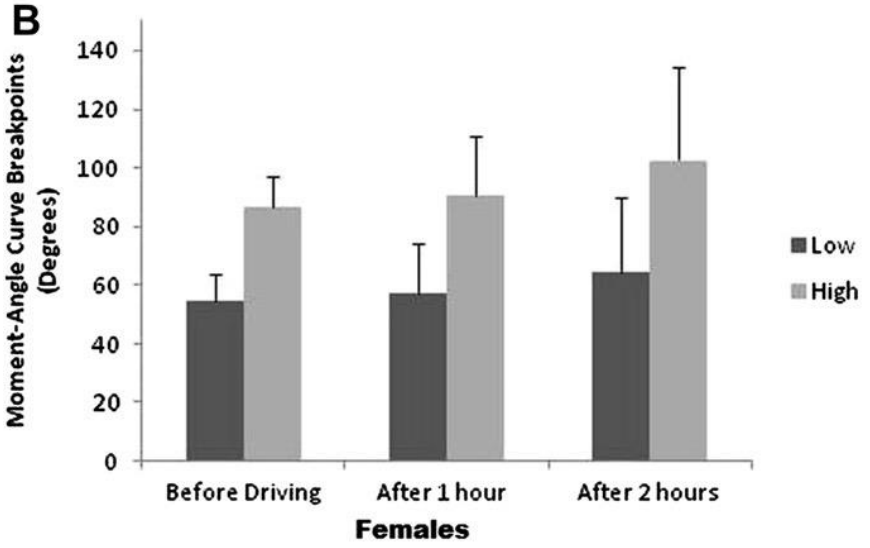
LUMBAR PASSIVE STIFFNESS RESPONSE TO AUTOMOTIVE SITTING

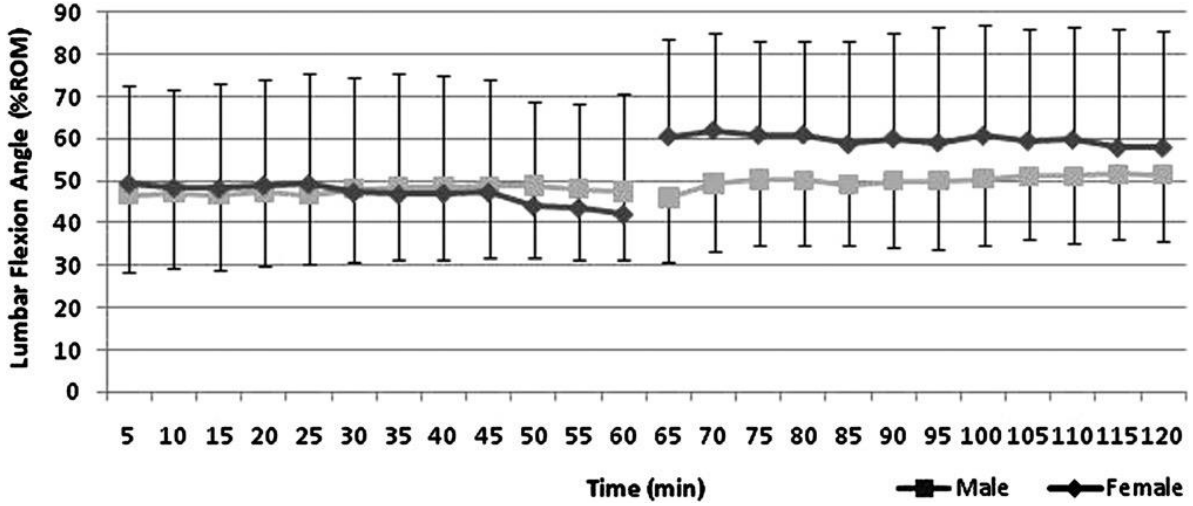




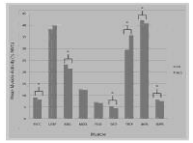


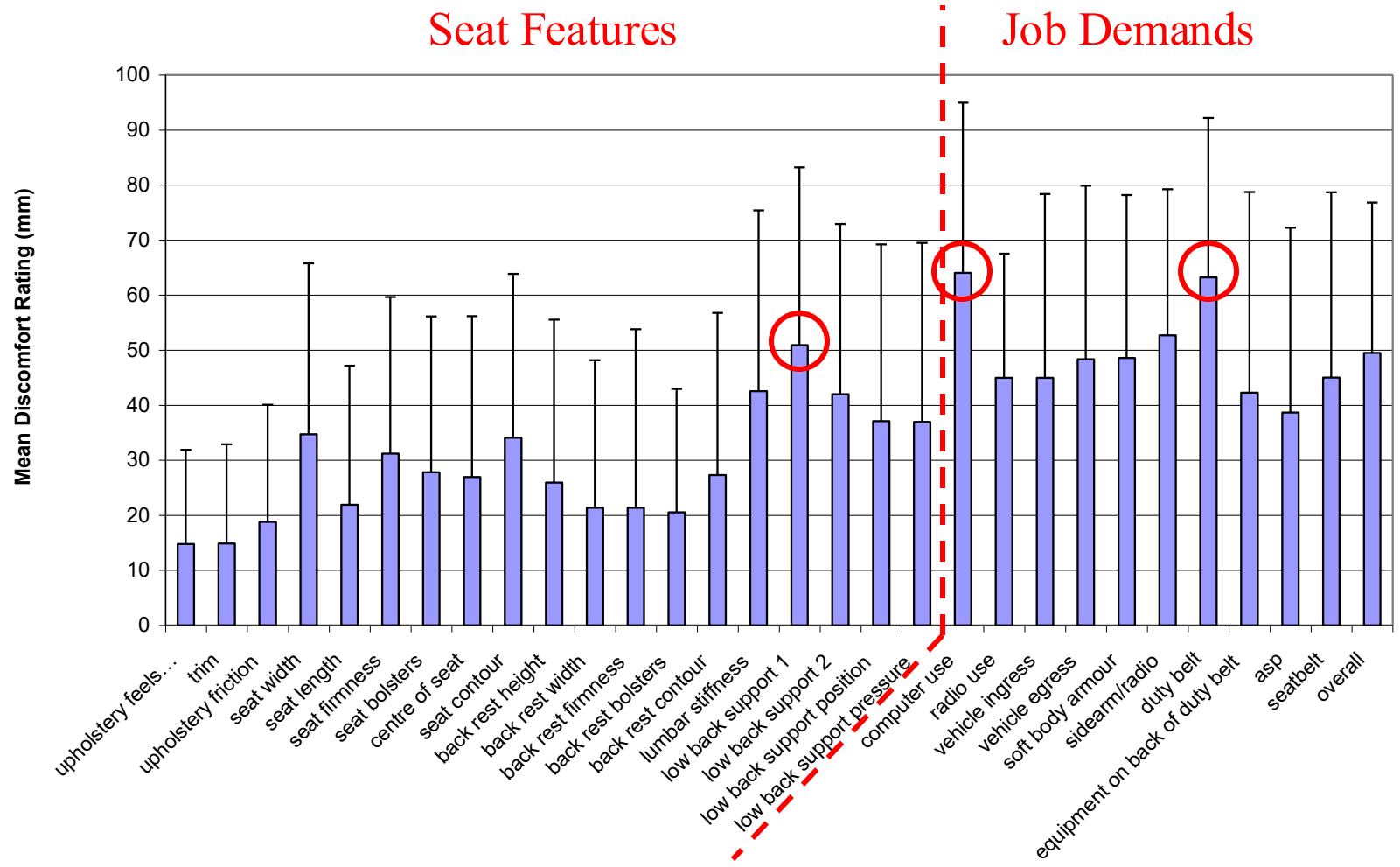




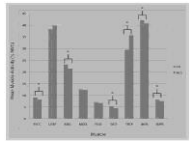


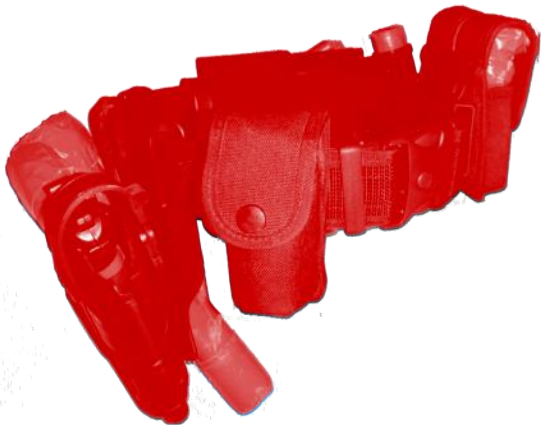
Discomfort Investigation by Seat Features and Job Demands

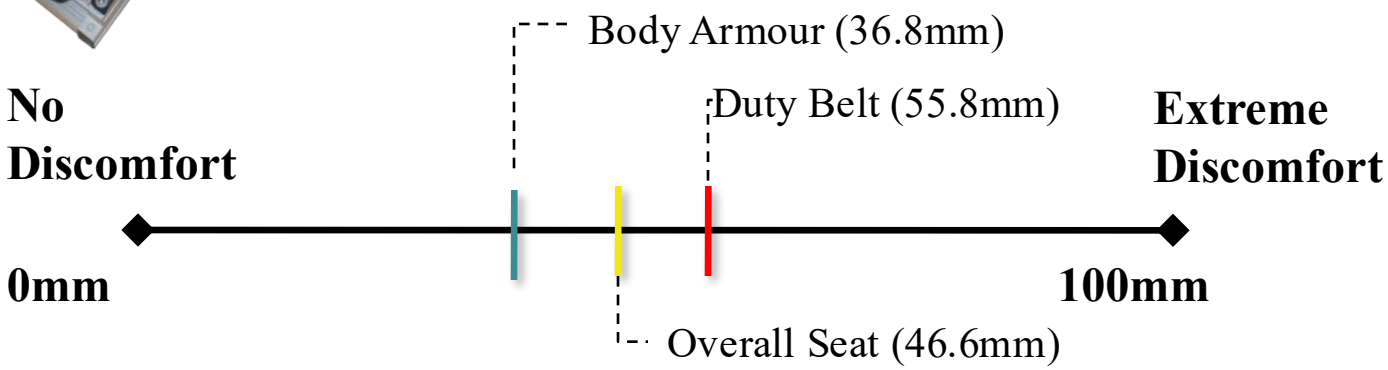




Phase 1 – Police Survey



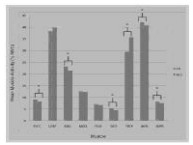




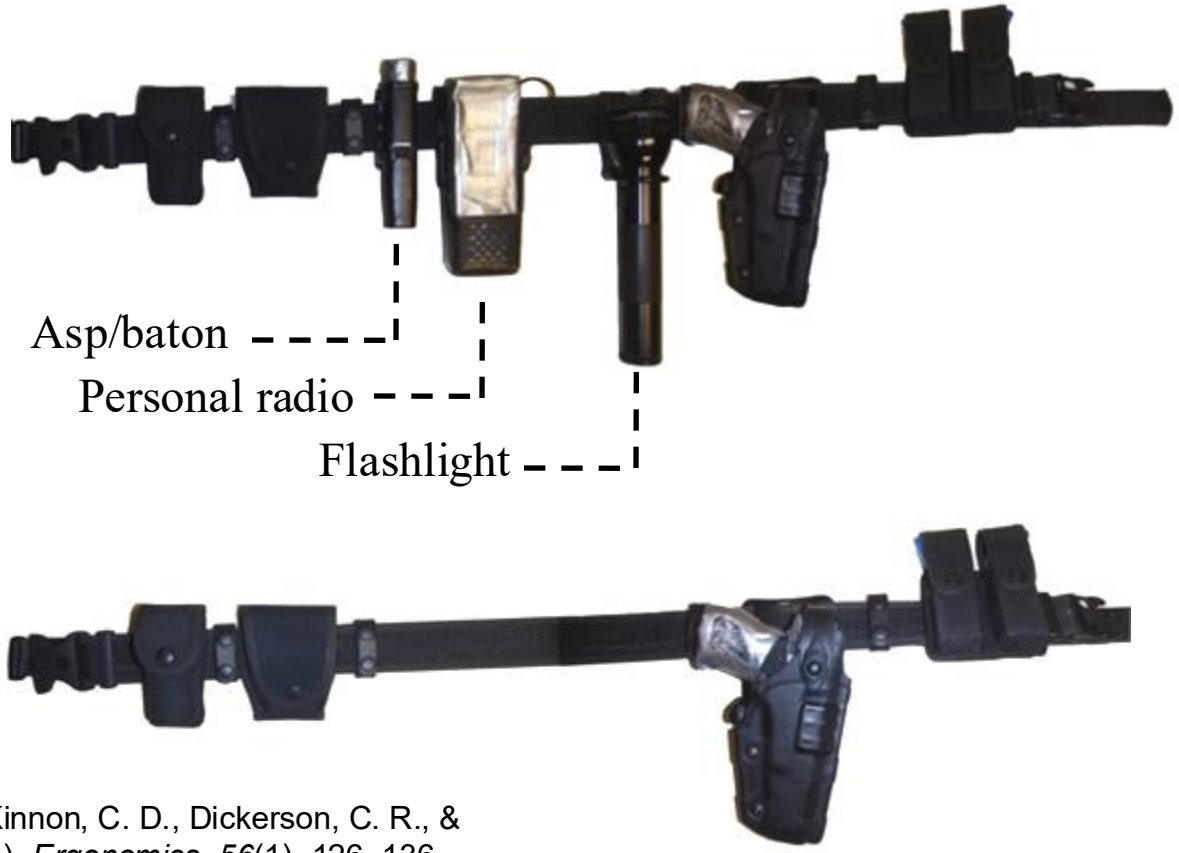
Methods – Duty Belt





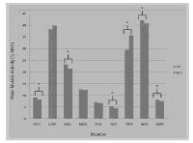


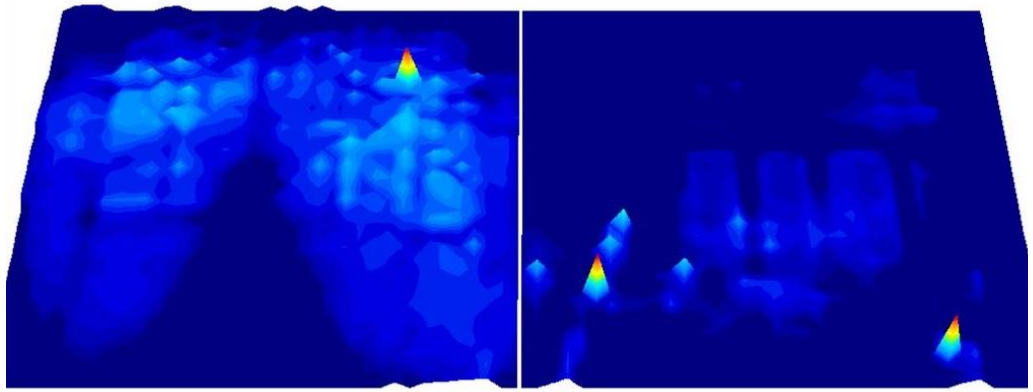

- Duty belt configurations:
  - full (FDB), reduced (RDB)

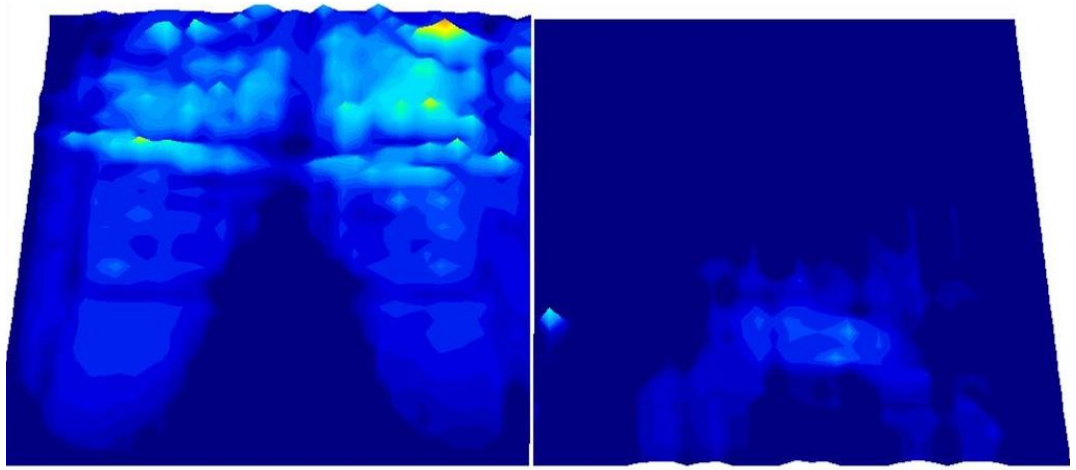


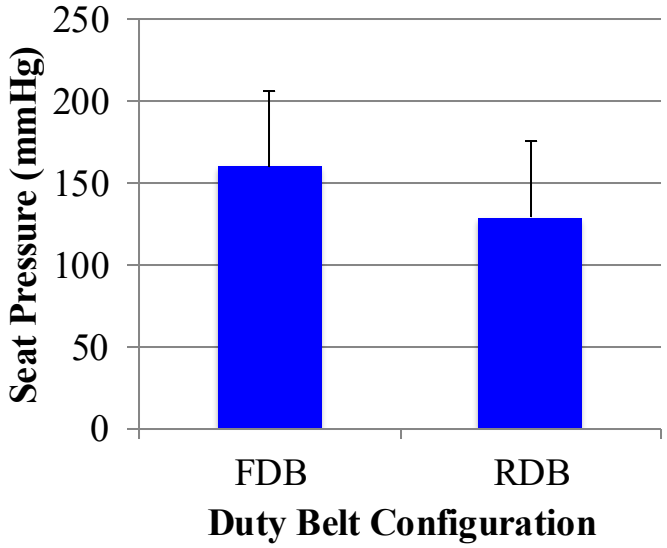
Holmes, M. W. R., McKinnon, C. D., Dickerson, C. R., & Callaghan, J. P. (2013). *Ergonomics*, *56*(1), 126–136.

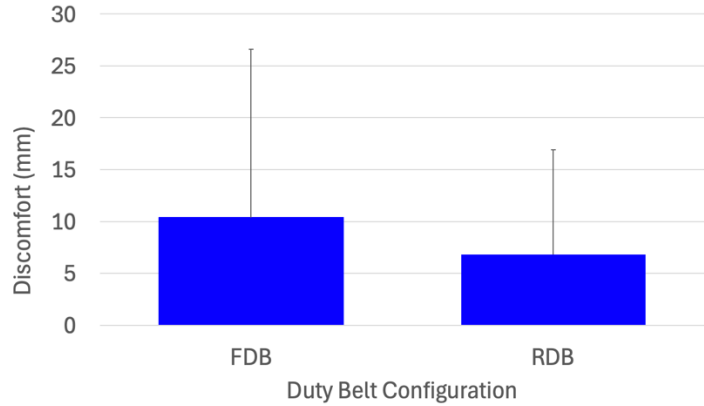
Duty Belt – Seat Interface



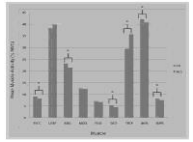








Phase 1 – Police Survey



Mobile Data Terminal (60.5mm)

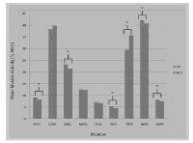
No Discomfort

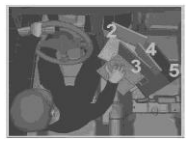
Extreme Discomfort

0mm

100mm

Methods

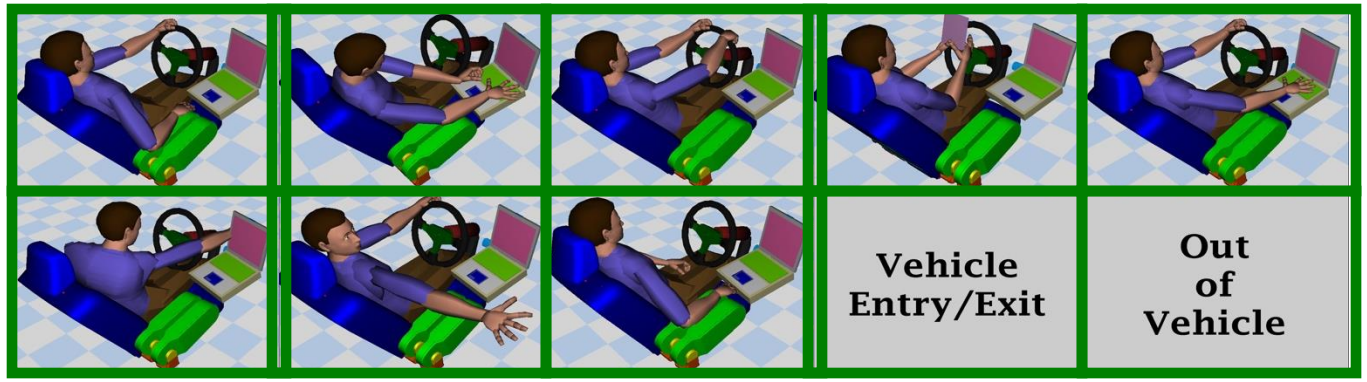




- In-car digital video capture
  - 3.6mm, 0.1 LUX Bullet Camera (Defender Security, Centerville, OH)
  - SunPlus SPCA506A (Bronzepoint Security Products, Belleville, IL)

Methods

- Common Activity Identification



Results

- Percent time in each posture
  - Full shift

Activity Posture	Mean Time (%)	Standard Deviation (%)	Rank
Officer out of vehicle	55.5	13.4	1
Left-handed driving (right-hand relaxed)	22.3	10.5	2
On-paper documentation	9.38	7.52	3
Right-handed MDT use	4.57	2.00	4
Two-handed driving	3.95	3.00	5
Vehicle entry/exit	1.28	0.49	6
Two-handed MDT use	1.23	1.06	7
Relaxed/Traffic watch	0.65	1.19	8
Right arm lateral reach	0.61	0.33	9
Right arm forward reach	0.53	0.36	10

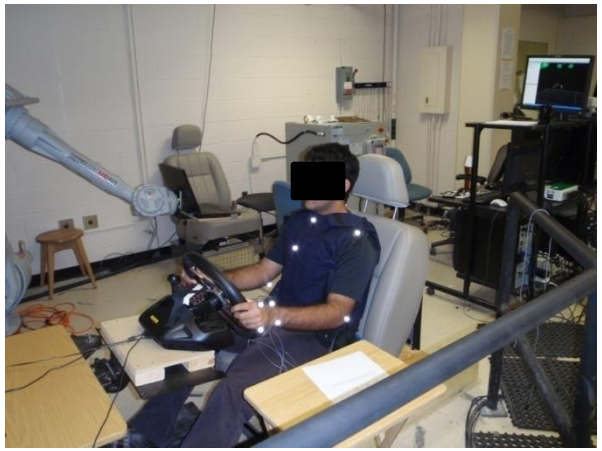
Results

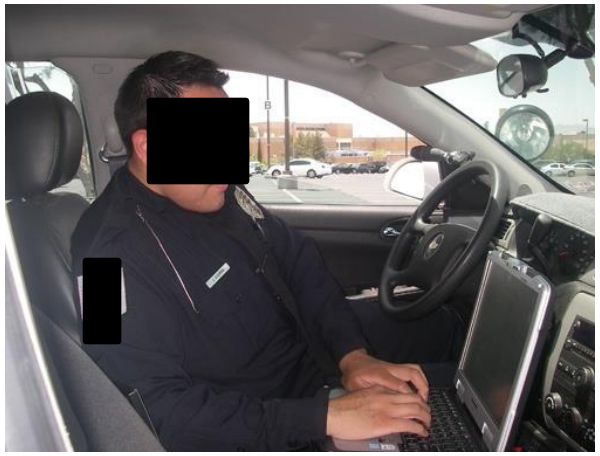
- Percent time in each posture
  - Time in vehicle (time out of vehicle omitted)

Activity Posture	Mean Time (%)	Standard Deviation (%)	Rank
Left-handed driving (right-hand relaxed)	50.3	15.7	1
On-paper documentation	20.8	16.5	2
Right-handed MDT use	10.3	3.99	3
Two-handed driving	8.98	6.54	4
Vehicle entry/exit	3.09	1.29	5
Two-handed MDT use	2.78	1.81	6
Right arm lateral reach	1.49	0.81	7
Relaxed/Traffic watch	1.20	2.08	8
Right arm forward reach	1.12	0.60	9

34% of Time Data Entry Related

Driving or MDT Usage?





VS

Average Peak Discomfort Typing vs Driving

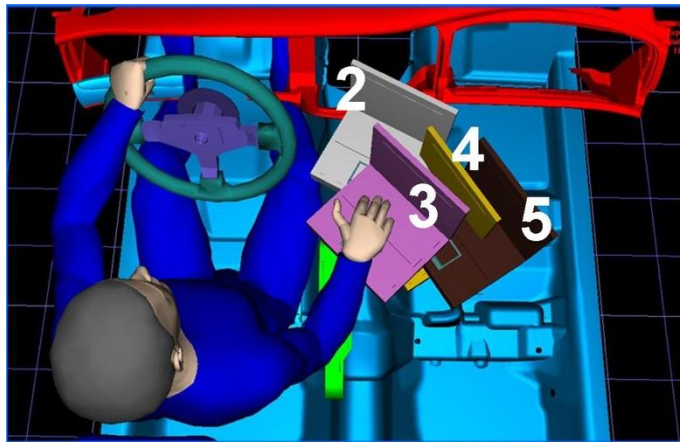
Body Location	Driving (mm)	Typing (mm)	P-value
Neck	3.7 (7.8)*	9.6 (10.2)	0.0434
(L) Shoulder	2.7 (5.4)*	9.5 (9.3)	0.0167
(R) Shoulder	2.5 (5.6)	8.1 (9.6)	0.0530
Upper Back	7.2 (11.0)	10.2 (10.6)	0.4209
Middle Back	8.6 (9.2)*	19.5 (13.4)	0.0024
Lower Back	19.6 (22.9)*	30.2 (17.8)	0.0464
Pelvis	9.9 (20.4)*	21.4 (24.4)	0.0043
Sacrum/Tail bone	10.8 (21.3)	20.3 (22.5)	0.1420
(L) Buttocks	9.3 (12.9)	15.4 (21.5)	0.1204
(R) Buttocks	8.9 (13.3)	17.7 (24.1)	0.0657
(L) Thigh	3.3 (4.5)	11.0 (20.6)	0.0889
(R) Thigh	10.2 (16.3)	12.2 (22.8)	0.7098

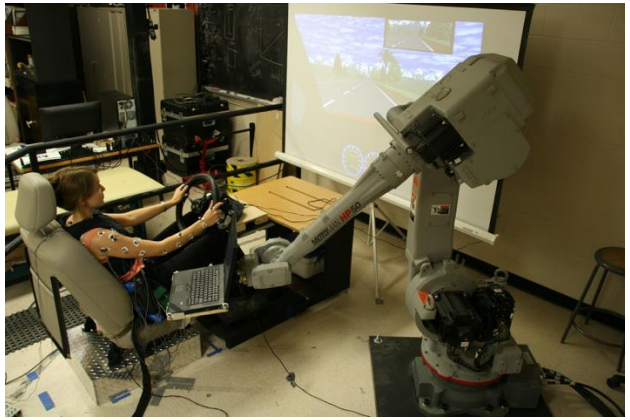
Average Peak Discomfort ↑During Typing Condition

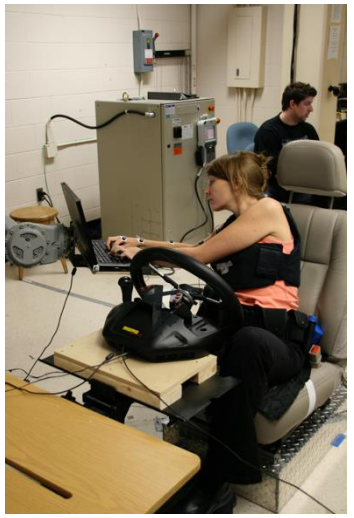
Body Location	Driving (mm)	Typing (mm)	P-value
Neck	3.7 (7.8)*	9.6 (10.2)	0.0434
(L) Shoulder	2.7 (5.4)*	9.5 (9.3)	0.0167
(R) Shoulder	2.5 (5.6)	8.1 (9.6)	0.0530
Upper Back	7.2 (11.0)	10.2 (10.6)	0.4209
Middle Back	8.6 (9.2)*	19.5 (13.4)	0.0024
Lower Back	19.6 (22.9)*	30.2 (17.8)	0.0464
Pelvis	9.9 (20.4)*	21.4 (24.4)	0.0043
Sacrum/Tail bone	10.8 (21.3)	20.3 (22.5)	0.1420
(L) Buttocks	9.3 (12.9)	15.4 (21.5)	0.1204
(R) Buttocks	8.9 (13.3)	17.7 (24.1)	0.0657
(L) Thigh	3.3 (4.5)	11.0 (20.6)	0.0889
(R) Thigh	10.2 (16.3)	12.2 (22.8)	0.7098

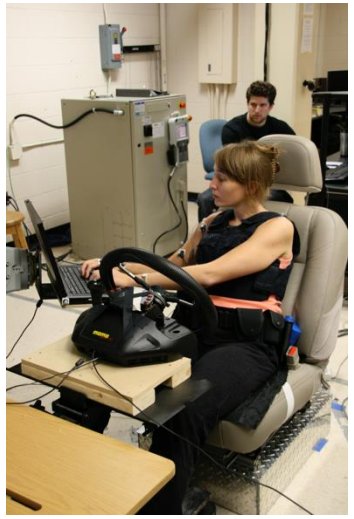
Can the MDT Discomfort be Mitigated by Location

Simulation Configuration

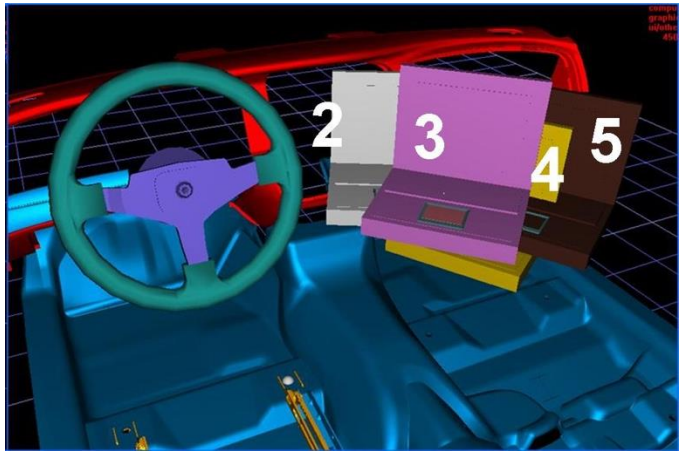




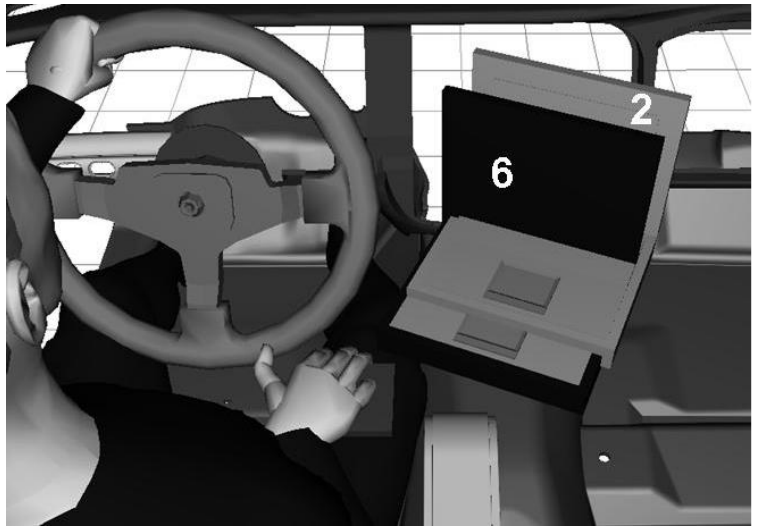




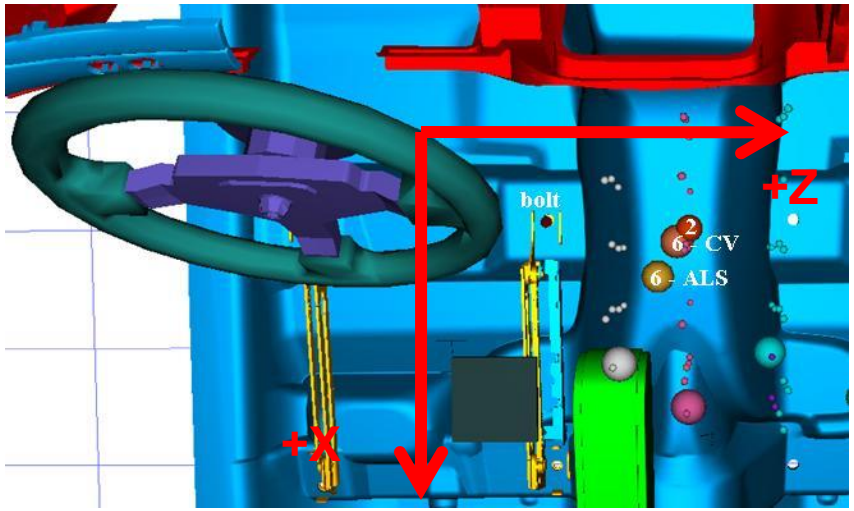
Evaluation of Mobile Data Terminal Location During a Simulated Police Patrol Task Set

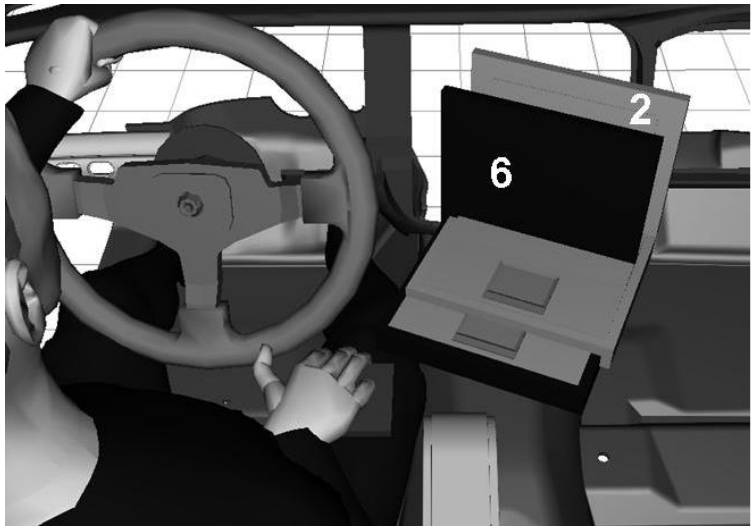


	Outcome Measure Rank				
Outcome Measure	**Location 2**	**Location 3**	**Location 4**	**Location 5**	**Location 6**
Shoulder RPD	2	4	3	5	1
Low Back RPD	2	3	4	5	1
Mean Elevation Angle	2	5	4	3	1
Mean Resultant Dynamic Shoulder Moment	4	2	1	5	3
Muscle Activity Total	3	4	2	5	1
Total Predicted Muscle Force	1	4	5	2	3
Average Rank	2.33	3.67	3.17	4.17	1.67
Rank Order	**2**	**4**	**3**	**5**	**1**



MDT Location





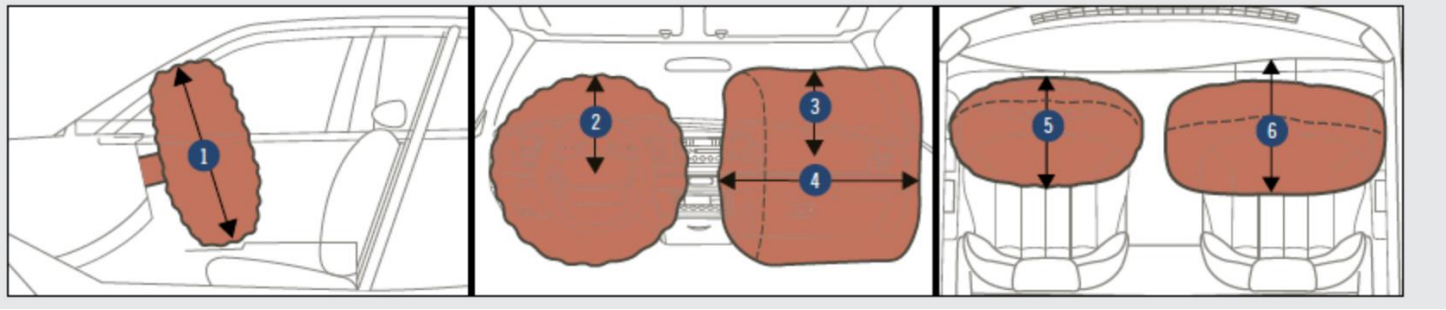
X = 2.96 cm
Y = 45.09 cm
Z = 23.21 cm

Positive X direction is posterior; positive Y direction is superior; positive Z direction is right (towards passenger seat).

Crown Victoria Decommissioned

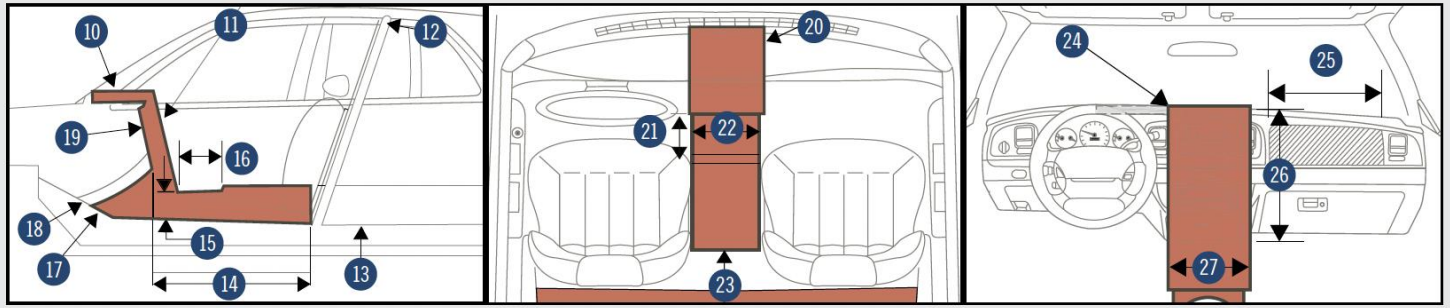
EQUIPMENT MOUNTING GUIDE**

CLEAR AREA AROUND STANDARD FRONT AIRBAGS

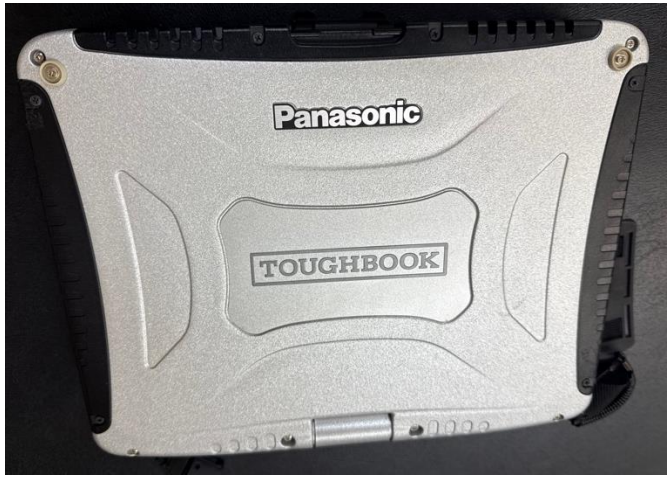


Safe Zone on Console
Width 9-11" (23-28cm)
Depth 1.5" (4 cm)

CLEAR AREA AROUND CENTER CONSOLE



MDT Exemplar with no Mounting Hardware:
Width 27cm
Depth 6 cm



TAKE AWAY MESSAGES (N=3)

1. Scope of problem

   Appears to be an Injury/Lost time issue

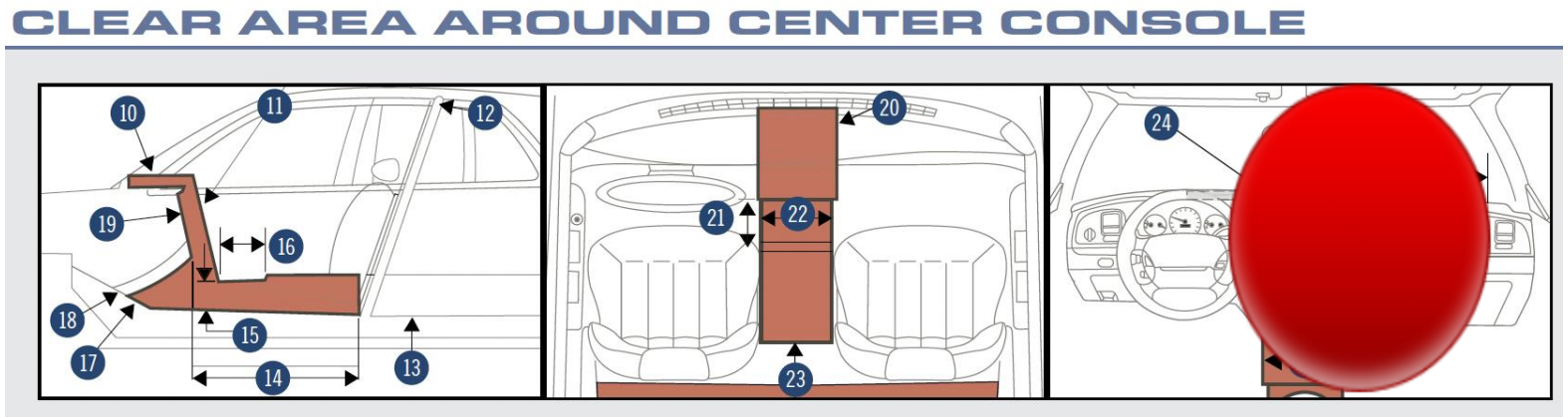
2. Research has identified MSD hazards

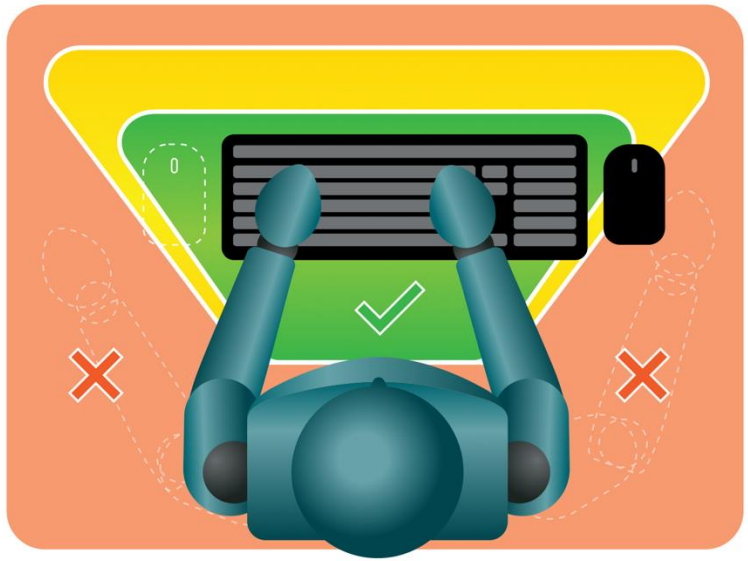
   Awkward and sustained postures, contact stress, and vibration (prolonged driving)

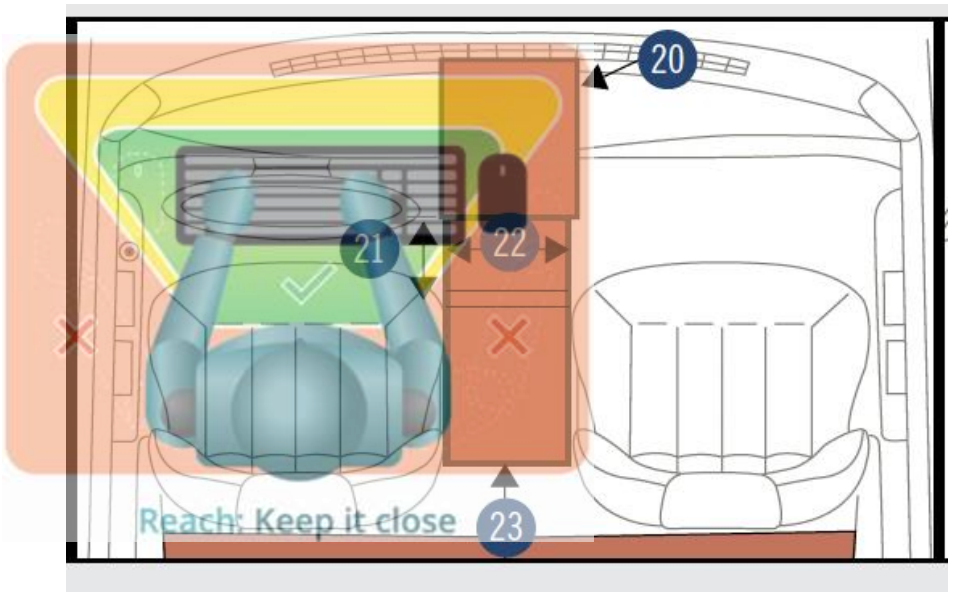
3. Link between MSD and annual driving mileage exists

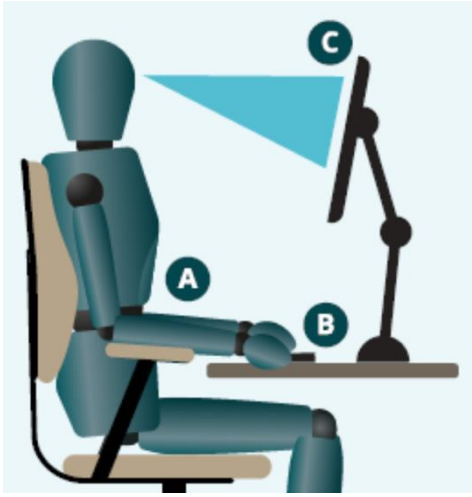
   - 50% of their shift seated in the vehicle
   - Members of a high vehicle usage group
   - Police officers should make an effort to take breaks out of their cruisers to offset prolonged exposures to seated postures

Vehicle versus Office Ergonomics









In-Vehicle Computing Ergonomics Checklist

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

Job title: _____

Date: _____

Analyst: _____

Assessment Area		Recommendation(s)
Driver Seat		
Is there space between the seat pan and the back of the legs?	YES ☐ NO ☐	Two fingers space between the seat and the legs is ideal
Do the seat pan side supports cradle the thighs?	☐ ☐	Side cushions should not put excessive pressure on the thighs
Is the seat cushion soft at the front and firm under the buttocks?	☐ ☐	Frequent entry/exit can degrade seat cushions and decrease seat support
Is the backrest tilt adjustable?	☐ ☐	Seat pan-seat back angle should be 90-110 degrees
Does the seat back have a curved lumbar support?	☐ ☐	A 3-5 cm deep lumbar support can improve low back posture
Upper Body		
Can driver reach all vehicle controls (radio, wipers, temperature) while seated?	YES ☐ NO ☐	Repeatedly leaning forward to reach controls can cause discomfort
Is the steering wheel position adjustable?	☐ ☐	Elbows should be at the side while reaching to 9:00 and 3:00 on the wheel
Is there sufficient head room in the vehicle?	☐ ☐	Lack of headroom can lead to slouching and poor back posture
Ingress/Egress		
Can driver exit the vehicle without adjusting the seat and/or steering wheel position?	YES ☐ NO ☐	Repeatedly adjusting seat can lead to inappropriate setup while driving
Can driver exit vehicle with 3-point contact?	☐ ☐	3-point contact helps maintain balance, stability, and good postures

In-Vehicle Computing Ergonomics Checklist

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

Assessment Area		Recommendation(s)
Mobile Computer		
Is the mobile computer position adjustable?	YES ☐ NO ☐	Self-selected position can reduce discomfort and physical demands
Can driver reach mobile computer without twisting low back?	☐ ☐	Extended use in a twisted posture can lead to low back injury
Can driver reach mobile computer with two hands and elbows at the sides?	☐ ☐	Reaching can cause shoulder loading and discomfort
Can mobile computer swivel left and right?	☐ ☐	Keyboard should be perpendicular to the forearms to keep neutral wrists
Can mobile computer be adjusted within 20 seconds?	☐ ☐	Complex adjustment processes may cause users to avoid adjustment
Can mobile computer be locked in a safe position while driving?	☐ ☐	Driver safety may be at risk in the event of an airbag deployment
Rest and Work Environment		
Does driver exit vehicle at least once per hour?	YES ☐ NO ☐	Static postures can lead to fatigue, discomfort, and injury
Can mobile work be performed in a standard office environment?	☐ ☐	Variations in work posture are the best way to prevent discomfort

If you answered **NO** to any of the preceding questions, a full risk assessment may be required to limit any potential mobile workplace hazards.

Additional Comments:

_____

_____

_____

_____

_____

_____

University of Waterloo
May 2018

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

In-Vehicle Workstations

How to set up for **short term**, in-vehicle mobile device use, such as laptops and tablets

FOR YOUR SAFETY:

- Never use mobile devices when operating a vehicle
- Ensure the vehicle is parked safely (away from moving vehicles) and turned off while working on mobile devices
- Working in the vehicle is not optimal as there are risks associated with working in front of airbags

Do you need to work in the vehicle?

In-vehicle workstations are not an effective replacement for a properly set up office workstation

- Consider a remote workstation with a work surface as an alternative to reduce awkward postures and eliminate safety risks
- A work surface allows for use of external devices, such as a laptop/tablet riser, external keyboard and mouse

If you are required to use mobile devices in-vehicle:

1. INCREASE WORKSPACE

- Adjust seat rearwards
- Work in the passenger seat or rear seats

2. CENTER THE SCREEN

- Position the screen in front of the body
- Centre the screen with the vertical mid-line of the body to avoid twisting at the back and neck

3. USE SUPPORTS TO RAISE THE SCREEN

- Use mobile mounts or holders to improve neck posture
- Use voice-based input systems to reduce awkward shoulder, arm and wrist postures

4. EXIT THE VEHICLE TO CHANGE POSTURE

- Get out of the vehicle at least once per hour
- Do NOT work in-vehicle for long periods of time

DO NOT WORK IN-VEHICLE FOR LONG PERIODS OF TIME

Working directly on a laptop/mobile device creates musculoskeletal disorder (MSD) hazards:

- Flexed neck posture to view the screen
- Awkward wrist/elbow/shoulder postures to type and use the trackpad/screen

Exposure to MSD hazards for sustained durations increases the risk of discomfort and MSD.

For more info visit: msdprevention.com

RESEARCH MEETING PRACTICE TO PREVENT MUSCULOSKELETAL DISORDERS (MSD)

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

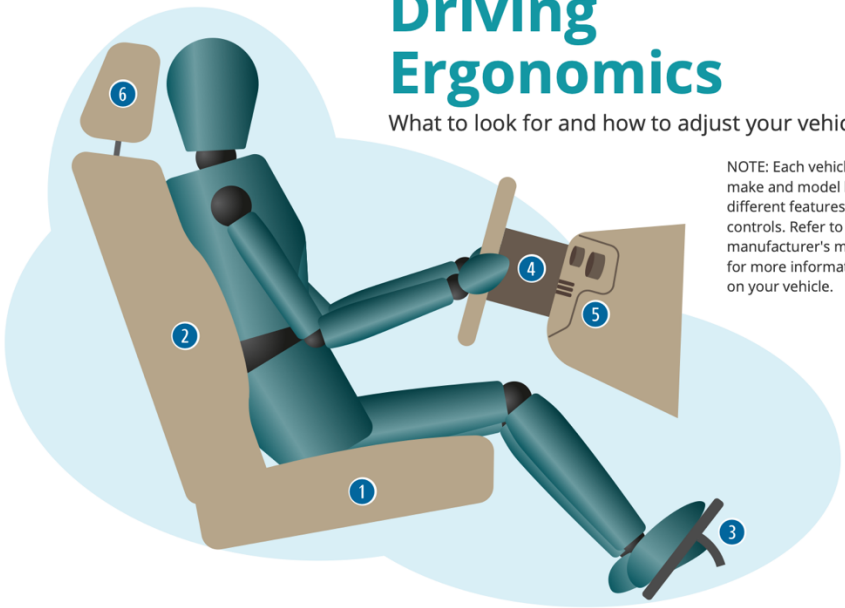
Work shouldn't hurt

Workstation

Driving

Driving Ergonomics

What to look for and how to adjust your vehicle



NOTE: Each vehicle make and model has different features and controls. Refer to the manufacturer's manual for more information on your vehicle.

6 Key Areas of Focus for Ideal Driving Postures

1. SEAT PAN

Height: raise to allow for increased visibility while allowing for head clearance to sit upright

Angle: adjust to evenly support thighs on the seat

Length: adjust to allow space (2-3 fingers) between back of knee and seat edge

Shape: cradle thighs – no pressure points

Cushion: firm support

2. BACKREST

Angle: adjust 90°–110° from the seat pan

Lumbar support: position the height of the support on the low back and adjust the depth between 2-4 cm from the backrest

3. PEDALS

Distance: adjust seat forward or backward to depress pedals without extending the hip and knee or leaning forward out of the backrest

4. STEERING WHEEL

Distance: adjust to at least 25 cm from body (for air bag deployment)

Angle: adjust to allow relaxed arm position and leg clearance

Technique: hold the sides of the wheel (9:00 & 3:00 positions) to maintain relaxed arm positions, close to the body

5. CONTROLS

Distance: adjust seat forward or backward so controls are within full arm's reach

6. HEAD RESTRAINT

Height: adjust between ear level and top of head

Angle: adjust so that it is touching or positioned just behind the back of the head in an upright neck position

For more info visit: msdprevention.com

RESEARCH MEETING PRACTICE TO PREVENT MUSCULOSKELETAL DISORDERS (MSD)

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

Work shouldn't hurt

TALK OVERVIEW

- Disclaimer
- Sedentary Work Exposures Background
- Office Work exposures and best practice
- Police Cruiser MDT Related Work – where safety and safer conflict
- **MSD Resources**

Guideline Website

Understanding MSD
- Types of MSD interactive diagram

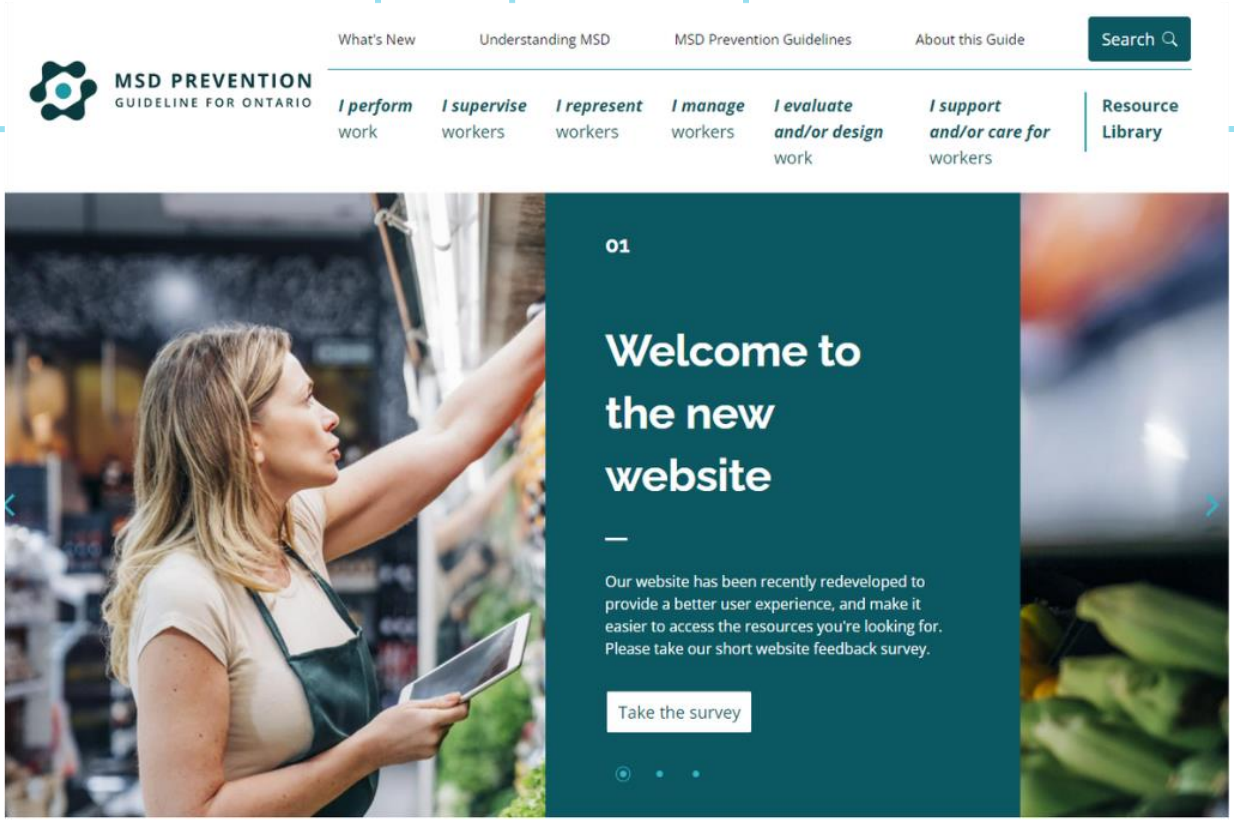
MSD Prevention Guidelines
- Guideline selector

Resource Library
- Improved search

What's New
- Resource highlights

Stakeholder Pages
- User centered
- Ex. I perform work

Curated resources for each user group



Case Studies and Stories

Recognize, Assess, Control, Evaluate (RACE)

MSD PREVENTION
GUIDELINE FOR ONTARIO

CRE-MSD
Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

Quick Start Guideline

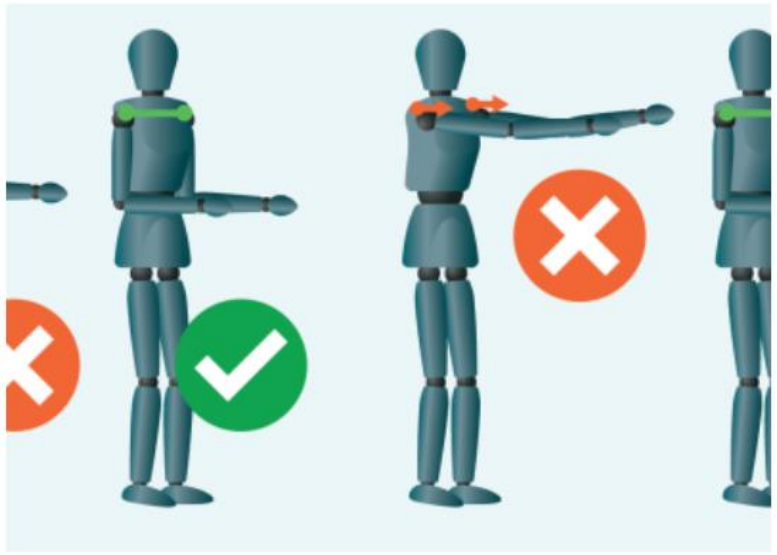
General

Office

Body Positioning Posters

View this series of three posters that show the proper body positioning to reduce risk of MSD injury to the shoulder, knee, and low back.

Focus on the Low Back



Focus on the Shoulder

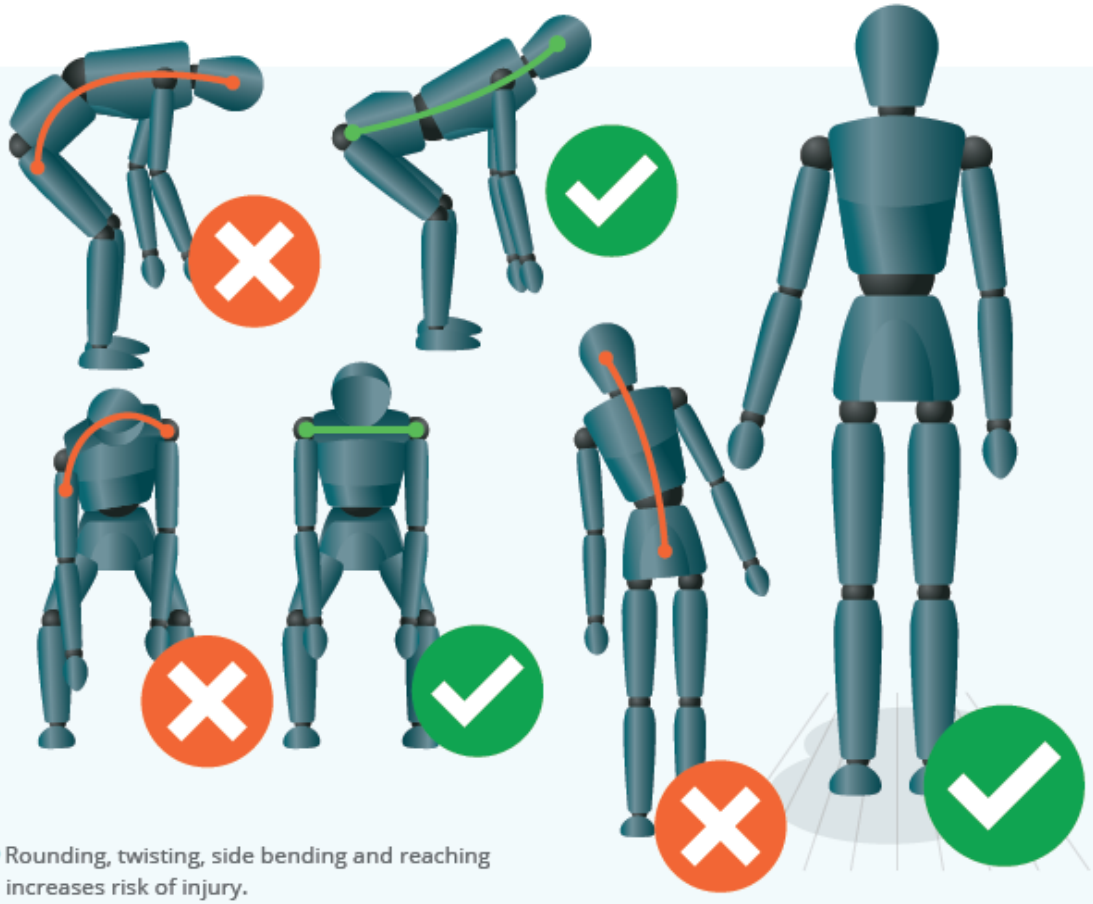
Focus on the Knee

- Focused on graphics and easy-to understand messaging
- Green, yellow, orange colour scheme used throughout resources

Positioning the Body to Reduce MSD Injury Risk

FOCUS ON THE LOW BACK

The low back is the most commonly injured body part due to workplace hazards in Canada.



- Rounding, twisting, side bending and reaching increases risk of injury.
- Keep good spine posture and limit spine movement to reduce injury when lifting or handling loads.

Whole body positioning should be part of a holistic ergonomics program that involves engineering and administrative controls for modifiable tasks. The hierarchy of controls should be followed when addressing hazards.

Positioning the Body to Reduce MSD Injury Risk

FOCUS ON THE LOW BACK

Examples of Tasks:

DID YOU KNOW?

- To reduce risk of injury:
  - A Avoid repetitive rounding, bending, and twisting of the lowback
  - Keep the load close to the body
- Low back injury consequences include:
  - Missed time from work
  - Decreased job satisfaction and quality of life
  - Decreased confidence in work-related tasks
  - Delayed return to worktasks

KEEP IN MIND

- When handling heavy loads:
  - B Limit rounding, bending and twisting of the low back
  - Maintain a firm grip on the load
  - Prepare the body (or low back) by shifting or tilting the load before handling
  - C Keep the load close to the body by moving the feet to improve leverage
  - Position the feet to improve balance and optimize applying force
  - Try to modify activities to minimize load handling frequency and time

LEGEND

GREEN – No action required if tasks are not held or repeated for long periods and no MSD symptoms are reported. Continue to monitor for MSD symptoms and check after workplace or process changes.

YELLOW – Investigations and improvement needed in the longer term. Investigation and improvement needed immediately if MSD symptoms are present.

ORANGE – Further assessment or improvement needed immediately.

For questions, comments and suggestions please contact:
info@msdprevention.com

Manual Materials Handling Solutions to Control MSD Hazards in Manufacturing & Warehousing

Manual materials handling includes lifting, lowering, carrying, pushing, pulling and gripping materials.

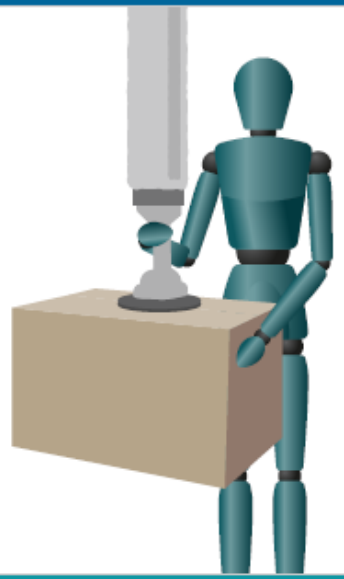
- These tasks are considered a major cause of back disorders in industry.
- In manufacturing, back injuries account for ~50% of all exertion/bodily reaction injuries (WSIB, 2020).

Eliminate or control musculoskeletal disorder (MSD) hazards associated with manual materials handling tasks by following the hierarchy of controls:

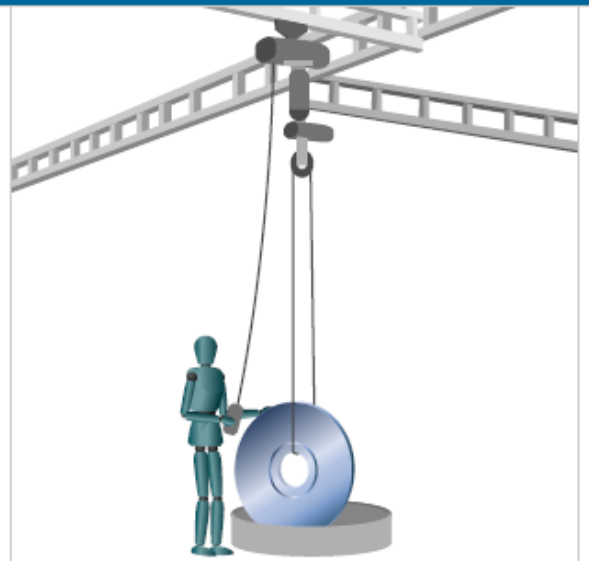
- Investigate implementing engineering controls, such as the solutions provided below, to change the way work is performed. These solutions can often improve worker productivity and product quality.
- Implement necessary administrative controls, such as training.

MSD Hazard: Weight lifted/lowered – Solutions to eliminate manual lifting/lowering

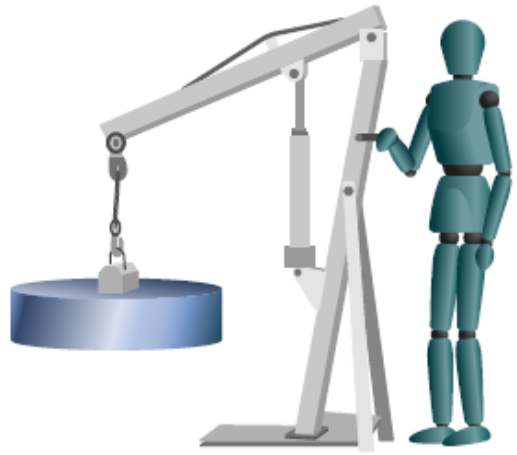
Roller/Transfer Table



Lift Assist Device



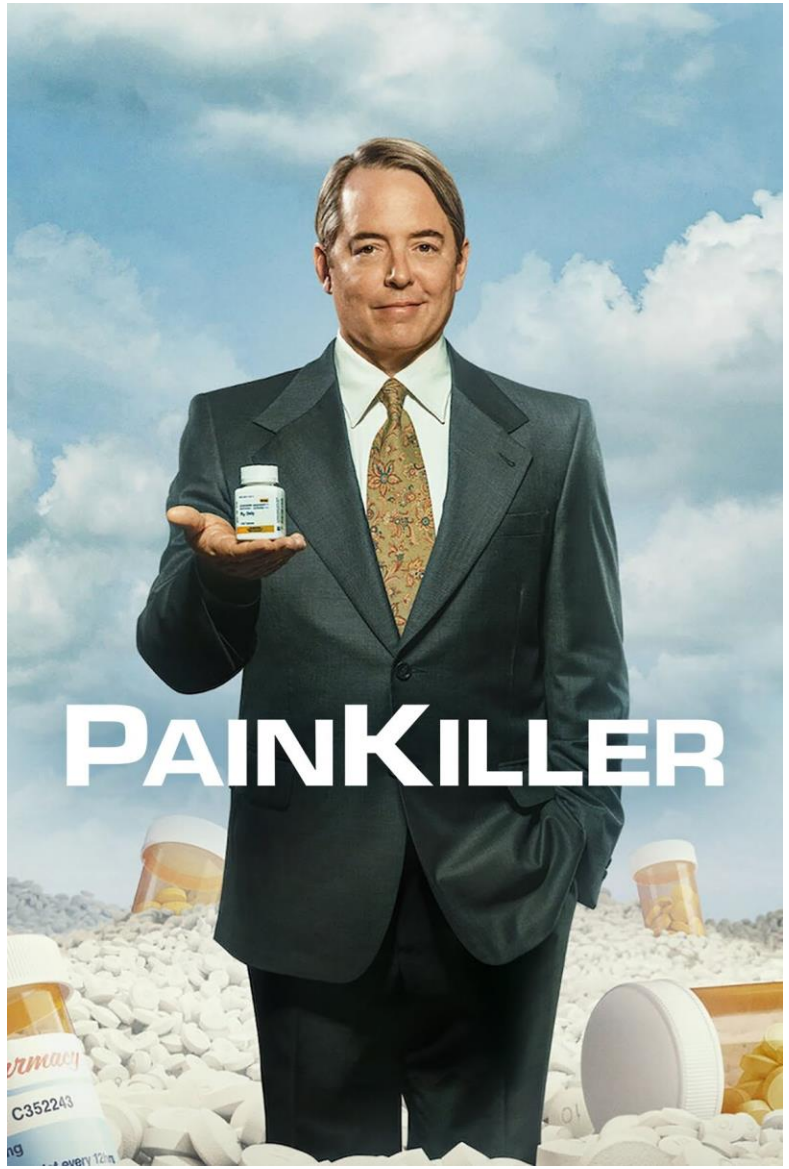
Overhead Crane/Hoist



Portable Crane/Hoist

PRE

H



MSD

Painkillers
Addiction

Mental
Health

Workplace Violence

Preventing MSD to reduce opioid use

Workers with musculoskeletal disorders (MSD) are at higher risk of opioid use and subsequent risk of opioid related harms. In some cases, this could result in the use of opioids at work to return to work early or avoid taking time off, which can pose additional safety risks in the workplace (e.g., during motorized equipment use). Primary prevention of MSD and related hazards is recommended and includes the reduction of physical and psychosocial hazards in the workplace.

PRIMARY PREVENTION

Harmful vibration | Hot/cold temperatures | High contact stress | High forces | High repetition | Awkward postures

PRESENCE OF PHYSICAL MSD HAZARDS

INCREASED RISK

Musculoskeletal disorders (MSD)

Lack of clear leadership & expectations | High psychological demands | Lack of psychological and social support | Insufficient protection of physical safety | Poor workload management

PRESENCE OF NEGATIVE PSYCHOSOCIAL FACTORS

INCREASED RISK

Poor mental health

Increased risk of opioid related harms

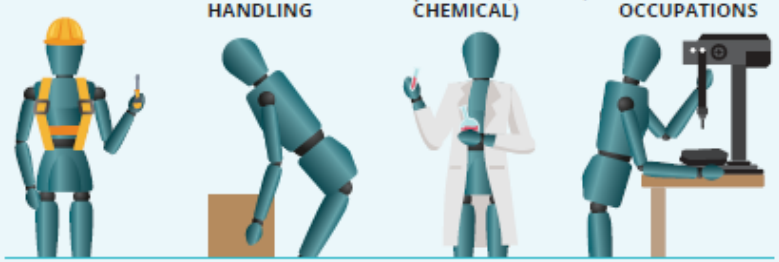
Opioid-related poisonings | Opioid use disorders

Preventing MSD to reduce opioid use

Which occupations are at highest risk of opioid-related harms in Ontario, among injured workers?

Almost all occupations were found to have elevated risk of opioid-related harms (except for teaching and related occupations) in injured workers compared to the general population. The occupations and activities at greatest risk included:

CONSTRUCTION TRADES | MANUAL MATERIALS HANDLING | PROCESSING (MINERAL, METAL, CHEMICAL) | MACHINING AND RELATED OCCUPATIONS



Note: Jobs with high physical demand generally had higher risk of opioid use in injured workers.

TRANSPORT | FORESTRY AND LOGGING | MEDICINE AND HEALTH

Additional job factors present in the workplace **may also increase the risk of opioid use,** including perceived financial or job insecurity, non-standard work arrangements (e.g., seasonal or contract work), workplace culture, and return to work recovery challenges.

Carnide et al., 2024.

What can you do to prevent MSD?

Workers – report discomfort early, and work with your supervisor to find solutions to remove MSD hazards.

Supervisors – ensure you know how to recognize MSD hazards in the workplace. Encourage workers to communicate feelings of discomfort using the discomfort survey, as this may indicate the start of an MSD.

Workers

Open communication and a positive workplace culture are key components of an effective MSD prevention program.

Supervisors | Managers and business owners

Managers and business owners

1. Implement an MSD prevention program using the Quick Start Guide General or Office, Basic, or Comprehensive Guidelines.
2. Use a participatory approach – encourage workers and supervisors to report early signs of MSD.
3. Use leading indicators (MSD hazards) as performance metrics.

SCAN HERE FOR OPIOID AND MSD PREVENTION RESOURCES

Mental Health and Psychosocial Hazards can interact with physical hazards to increase risk of MSD. Reduce psychosocial hazards to help reduce MSD and opioid use in the workplace using the psychosocial hazards and MSD poster.

Psychosocial Factors in the Workplace Influence Musculoskeletal Disorders (MSD) and Mental Health

Workplace psychosocial factors are cultural, social and psychological factors determined at or by the workplace that impact employees' responses to work and their work environment, which can result in negative mental health outcomes and increase the risk of MSD.

Understand the associations between work-related psychosocial factors and physical MSD hazards:

- Psychosocial factors can create stress responses, which could affect exposure to physical MSD hazards, and vice versa
- Presence of MSD hazards in the workplace can negatively impact physical and mental health
- Causal relationships are unclear between physical and psychosocial factors

? DID YOU KNOW

1. Psychosocial factors affect employees' perception of their work. These factors are within the influence and responsibility of employers and can impact the health and safety of employees.
2. Physical MSD hazards in the workplace and how work is organized can greatly increase a person's chance of developing an MSD. It is the responsibility of employers to control MSD hazards to protect workers.

PERSONAL FACTORS

Personal factors affect how workers respond to psychosocial factors and physical MSD hazards, which can influence health-related outcomes. Examples of personal factors include:

- Age, sex, gender
- Height and weight
- Level of experience
- Perception of work
- Personality traits, coping strategies

PSYCHOSOCIAL FACTORS

Leadership & Expectations
- Lack of clarity
- High responsibilities

Psychological Demands
- Monotonous work
- High concentration

Workload Management
- Time pressure
- High job demands
- Lack of support

Psychological & Social Support
- Lack of support from colleagues and/or supervisor

Involvement & Influence
- Low job control

Psychological Protection
- Lack of support

Protection of Physical Safety
- Exposure to uncontrolled hazards

POTENTIAL STRESS EXPOSURE SYMPTOMS

Behaviour Responses
- Rushing to complete tasks
- Not taking regular breaks
- Presenteeism

Physiological Responses
- ↑ Muscle tension
- ↑ Blood pressure
- ↓ Growth functions (healing)

Cognitive & Emotional Responses
- Frustration
- Fears about performance
- ↓ Confidence
- Sensitivity to pain

PHYSICAL MSD HAZARDS

High Forces
- Lift/lower
- Push/pull
- Grip/handle

Awkward Postures
- Body position away from strong, neutral postures

High Repetition (Frequency & Duration)
- Repetitive work
- Static postures

Vibration
- Hand Arm (HAV)
- Whole Body (WBV)

Contact Stress
- Pressure applied to body

INCREASED RISK OF PSYCHOLOGICAL HARM

INCREASED RISK OF MUSCULOSKELETAL DISORDERS (MSD)

MSD PREVENTION GUIDELINE FOR ONTARIO

For more info visit: msdprevention.com

EPID at work

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

© 2023 CRE-MSD. CRE-MSD receives funding through a grant provided by the Ontario Ministry of Labour, Immigration, Training and Skills Development (MLITSD). The views expressed are those of the authors and do not necessarily reflect those of the Province.

MSD Prevention and Psychological Health & Safety in the Workplace:

Building Alignment Contributes to Effective Programs

The **MSD Prevention Guideline for Ontario** and the **Canadian Standard for Psychological Health and Safety** share many overlapping factors as illustrated below.

- These commonalities demonstrate the importance of employers working to improve psychosocial factors in the workplace
- Focus on improving psychosocial factors can positively impact physical and mental health, job satisfaction, performance and productivity
- Learn more about workplace psychosocial factors from the Mental Health Commission of Canada

PSYCHOSOCIAL FACTORS CONTRIBUTING TO EFFECTIVE PROGRAM IMPLEMENTATION	MSD PREVENTION PROGRAM — MSD PREVENTION GUIDELINE FOR ONTARIO		PSYCHOLOGICAL HEALTH & SAFETY MANAGEMENT SYSTEM — CSA STANDARD Z1003-13	
Clear Leadership & Expectations Organizational Culture Engagement	STEP 1	DEMONSTRATE MANAGEMENT COMMITMENT & LEADERSHIP	SEC. 4.2	COMMITMENT, LEADERSHIP & PARTICIPATION
	STEP 2	FACILITATE & ENCOURAGE WORKER PARTICIPATION		
Workload Management	STEP 3	ESTABLISH SUPPORT & PLAN ACTIVITES	SEC. 4.3	PLANNING
Involvement & Influence Protection of Physical & Psychological Safety	STEP 4-6	IDENTIFICATION, ASSESSMENT & CONTROL • Recognize MSD hazards • Assess MSD hazards • Control or eliminate MSD hazards • Evaluate controls	SEC. 4.3	IDENTIFICATION, ASSESSMENT & CONTROL • Data collection • Diversity • Objectives and targets • Managing change
Growth & Development	STEP 7	PROVIDE EDUCATION & TRAINING	SEC. 4.4	IMPLEMENTATION • Infrastructure and resources • Education, awareness and communication • Competence and training • Preventative and protective measures
Engagement	STEP 8	EVALUATE PROCESS		• Sponsorship, engagement and change management • Governance • Critical event preparedness • Reporting and investigations
Recognition & Reward	STEP 9	COMMUNICATE RESULTS	SEC. 4.5	EVALUATION & CORRECTIVE ACTION
Clear Leadership & Expectations	STEP 10	MANAGEMENT REVIEW PROCESS	SEC. 5	MANAGEMENT REVIEW & CONTINUAL IMPROVEMENT

MSD PREVENTION GUIDELINE FOR ONTARIO

For more info visit: msdprevention.com

EPID at work

CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

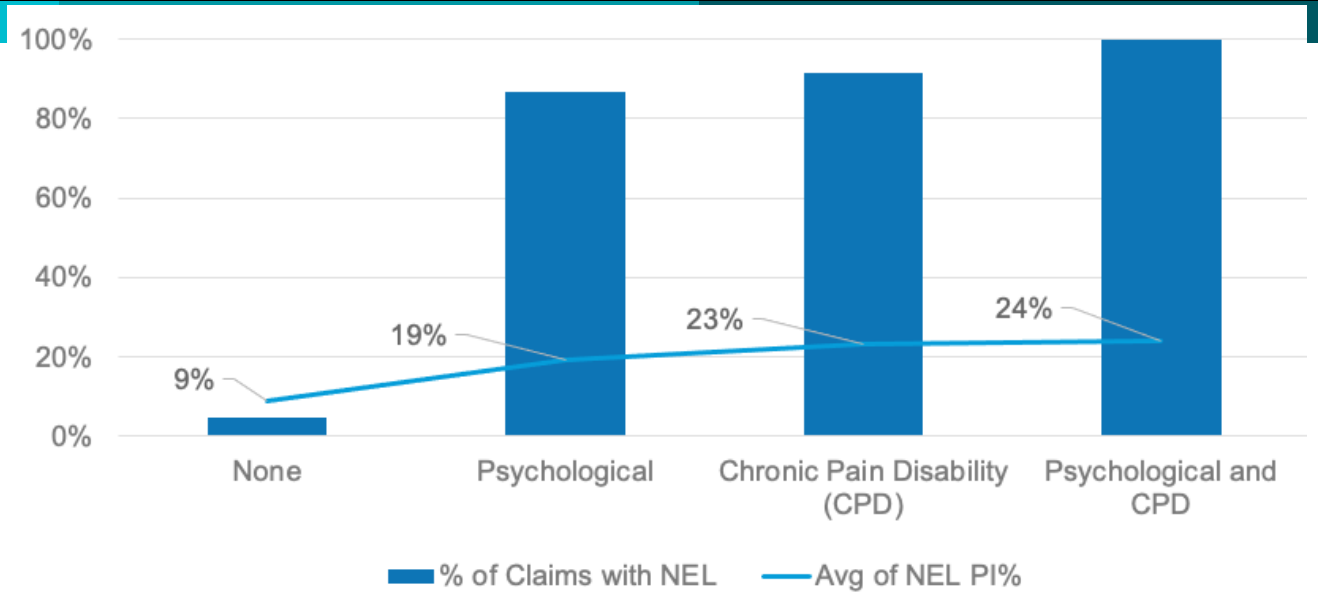
© 2023 CRE-MSD. CRE-MSD receives funding through a grant provided by the Ontario Ministry of Labour, Immigration, Training and Skills Development (MLITSD). The views expressed are those of the authors and do not necessarily reflect those of the Province.

PRESENT

H

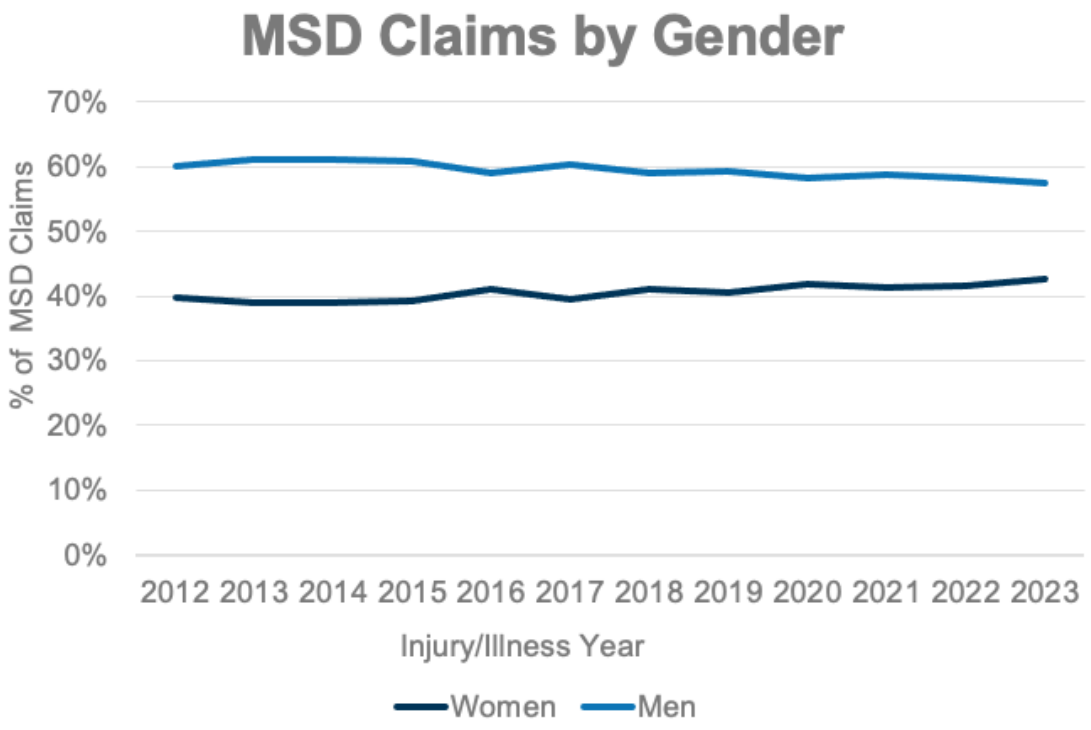
Secondary Claims

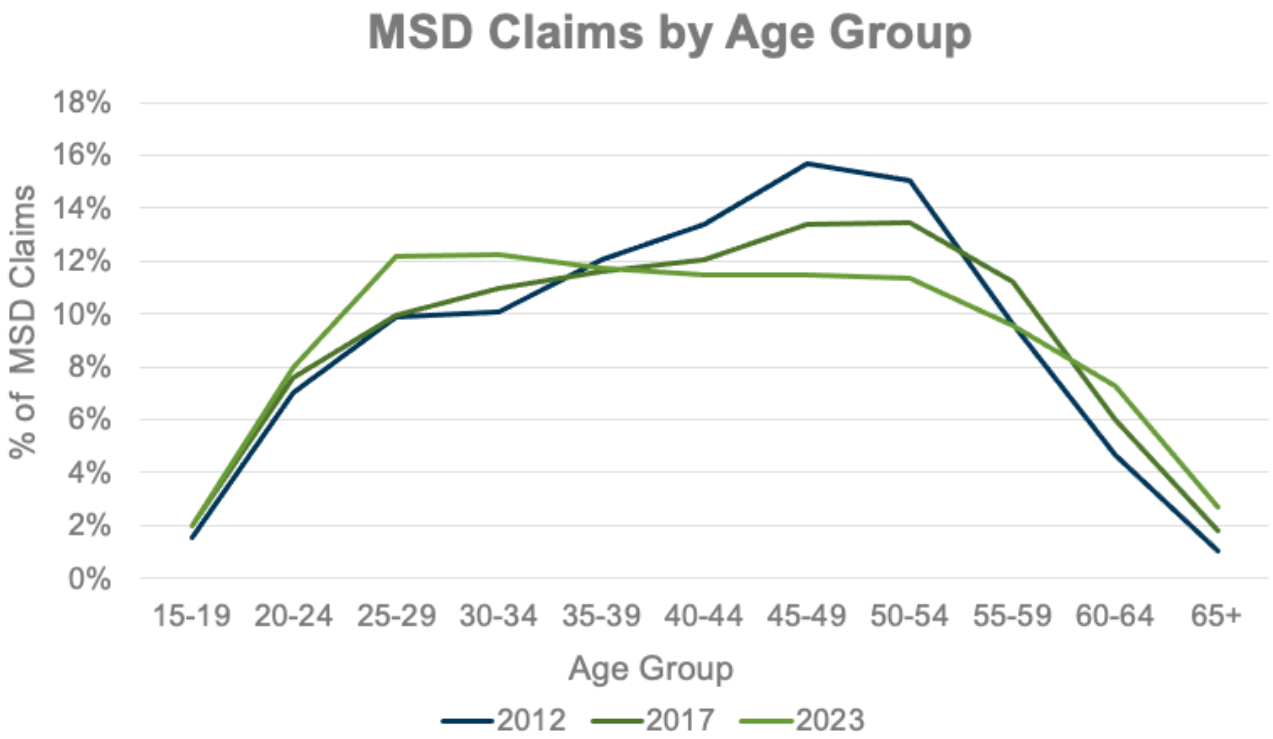
- Mental Health LTC is the fastest growing claim category
- 1% of MSD claims have secondary entitlement



Secondary Entitlement for Psych or CPD	Injury/Illness 2016 to 2019				
	% of A-LT MSD Claims	% with NEL Benefit	Average of NEL PI%	Average Benefit Cost Days Lost / Claim	Average Benefit Cost / Claim
None	99%	5%	9%	43.2	$7,403
Psychological Impairment	0.65%	87%	19%	1308.9	$187,295
Chronic Pain Disability (CPD)	0.02%	92%	23%	2269.9	$185,762
Psychological and CPD	0.02%	100%	24%	2318.1	$261,836
Overall	100%	5%	10%	52.8	$8,687

Age & Sex


MSD Claims by Gender
70%
60%
50%
40%
30%
20%
10%
0%
% of MSD Claims
2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023
Injury/Illness Year
Women
Men


MSD Claims by Age Group
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
% of MSD Claims
15-19 20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65+
Age Group
2012
2017
2023

SIGN UP FOR THE CRE-MSD NEWSLETTER TO STAY UP TO DATE ON NEW RESOURCES

THANK YOU

Ontario Innovation Trust

Canada Foundation for Innovation
Fondation canadienne pour l'innovation

WSIB ONTARIO CSPAAT

CRE-MSD
Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

Canada Research Chairs
Chaires de recherche du Canada

Canada

Ontario Ministry of Labour

CIHR IRSC

Networks of Centres of Excellence
Réseaux de centres d'excellence

NSERC CRSNG

Auto21

YRPA

York Regional Police

Waterloo Regional Police

Windsor Police