A Truly Remote Workstation Working from Your Car

International RSI Day
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Presentation Outline

Musculoskeletal disorders and driving
- *Vibration, static postures, non-neutral postures*

Solutions and suggestions
- *Driving postures*
- *Making adjustments*

Working in the car MSD issues
- *Working postures*
- *New technology*

Human factors
- *Staying safe on the road*

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Musculoskeletal disorders from driving

- Lower back, generalized back pain
- Spine – disc degeneration and herniation, sciatica, lumbago
- Neck
- Shoulder
- Knee – ITBFS
- Elbow
- Foot cramps

In UK termed RDI – “repetitive driving injury”

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(Szeto & Lam, 2007; Porter & Gyi, 2002 Leclerc et al., 2003; Chen et al., 2004)

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Who is at Risk?

- Forklift operators
- Truck drivers / Ambulance Drivers
- Heavy equipment operators
- Bus drivers
- Farmers
- Delivery and courier service workers
- Taxi / Limousine Drivers
- Travelling sales workers
- Commuters

ALL DRIVERS!

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What causes these MSDs?

- Whole body vibration
- Non-neutral postures – while driving and while working
- Static contractions
- Cramps, pressure points and poor blood circulation
- Lifting after driving
- Duration of driving. +30km per day = 2-4 times the risk of BP
- Psychological factors (stress)
- Fatigue

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(Tamrin et al., 2014; Porter & Gyi, 2002; Bovenzi et al., 2006; OHS Canada, 2000)

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Statistics

- Individuals who drove more than 20 hours a week for their job were absent from work with back pain at a rate six times higher than those who drove less than 10 hours per week as part of their job (Porter & Gyi, 2002)
- Non-neutral trunk postures while driving were significant predictors of lower back pain prevalence (Bovenzi et al., 2006).
- 50% of the drivers under-estimated the time they spent 'bending' (Tiemessen, Hulshof, and Frings-Dresen, 2008)

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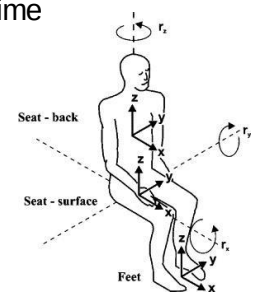
Back & Neck Injuries

- Main hazards
  - Sitting for long periods of time
  - Whole-body vibration
    - Possible awkward postures



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(Bovenzi et al., 2006; Kittusamy & Buchholz, 2004; Kittusamy, & Buchholz, 2001; Sherwin et al., 2004; Viswanathan et al., 2006)

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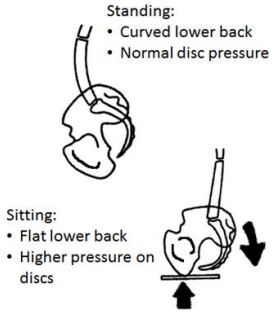
Sitting Hazards

- An **AWKWARD** posture
- A **STATIC** posture
- A **WORKING** *position*
- Hard on **DISCS & LIGAMENTS** of the back
- Restricts **BLOOD CIRCULATION** through the muscles = fatigue



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(Zimmermann, Cook, & Rosecrance, 1997).

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Long Term Sitting

- Sitting is a **static posture – <u>BUT not void of muscle contraction</u>**
- BUT, only some muscles NOT all – therefore, some muscles work constantly, while others do nothing!!

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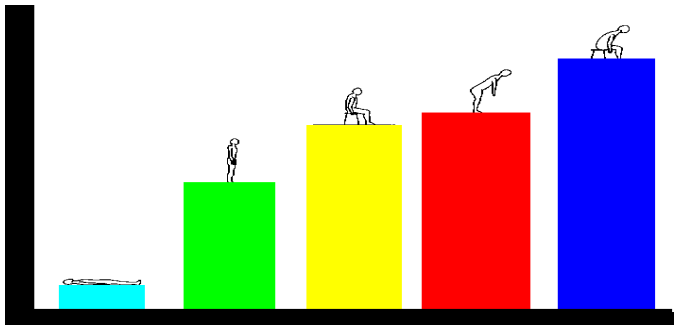
Posture and Lumbar Load



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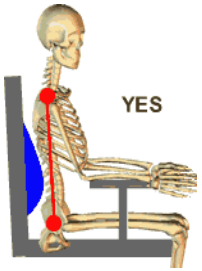
Backrests (Lumbar Supports)

- Sitting flattens lumbar curve
  - Changes biomechanics of spine
  - Increased forces on discs
  - Increased length of ligaments
  - Increased muscle tension
- Need support for curvature



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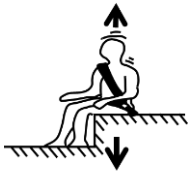
Whole-Body Vibration

- Transmitted through the back & buttocks when sitting
- Every object has a 'resonant frequency' (RF) 3-5 Hz – vibration from the road is often in the body's RF range; this increases the risk of injury
- Long-Term exposure:
  - Disc displacement
  - Degenerative spinal changes
  - Lumbar scoliosis
  - Intervertebral disc disease
  - Herniated discs
  - Disorders of gastrointestinal system



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(Sherwin, Owende, Kanali, Lyons, & Ward, 2004; Pope, Magnusson, & Wilder 1998; Bovenzi and Zadini 1992)

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Vibration is in all vehicles

- Caterpillars, excavators, bulldozers, graders, off-road forestry vehicles, heavy equipment used in mining, tractors, combines, forklifts, carrier trucks, dump trucks, other trucks, buses, vans, trains, subway cars, helicopters, snowmobiles, cranes, and even some cars, typically **expose their operators to vibration levels in excess of those recommended by ISO 2631-1** (International Standards Organization, Evaluation of human exposure to whole-body vibration (Teschke, Nicol, Davies, & Ju, 1999).

- Some suspension systems can result in an **amplification of vibration**

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Reducing Effects of Vibration

- Reduce **transmission**
  - Improve vehicle suspension
  - Maintain equipment properly
  - Proper engineering of seating
  - Use of materials that generate LESS vibration
- Decrease **amount**
  - Reduce speed of travel
  - Increase rest/recovery time between exposure
  - Alternate tasks to minimize vibration exposure

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Reduce – cont….

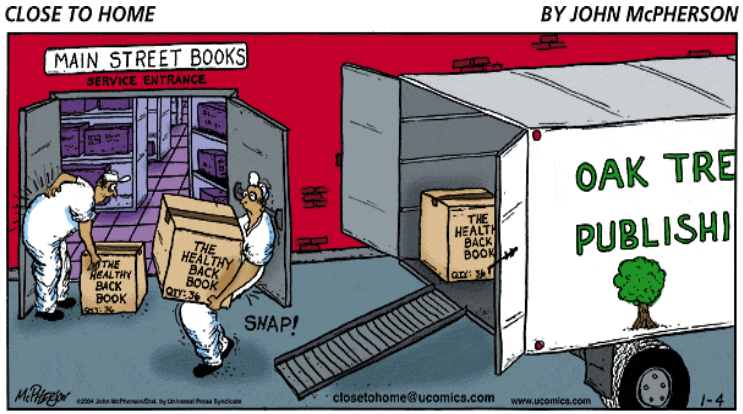
- **Modify the seat** and control positions
  - Back rest support
  - Reduce forward/sideways leaning of trunk
- **Eliminate awkward postures**
  - Difficulty seeing displays or reaching
- **Reduce or isolate** from the vibration source
  - Seated – spring or cushion (as an isolator)
- **Measuring vibration** – Phone APP https://crosh.ca/

Knee, shoulder, elbow, foot

- **Knee** pain - non-neutral postures (90 degrees), repetitive use, pressure from too large of a seat
- **Shoulder** pain from elevated arms, manual cars
- **Elbow** – ulnar neuropathy – compression of the ulnar nerve
  - Do not drive with your elbow resting on the window

- **Foot** cramps
  - Make sure full foot can be on pedal, not extending only with toes

Lifting after Prolonged Sitting



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Manual Handling Tips

- Adopt good postures when MMH
- Get as close to the item as possible – therefore organize the trunk accordingly
- Try to park as close as possible to drop off point.
- Take care when MMH after a long drive – walk before handling, light movements > stretching
- Use wheeled bags, wheeled suitcases, trolleys
- Multiple trips

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http://drivingergonomics.lboro.ac.uk/

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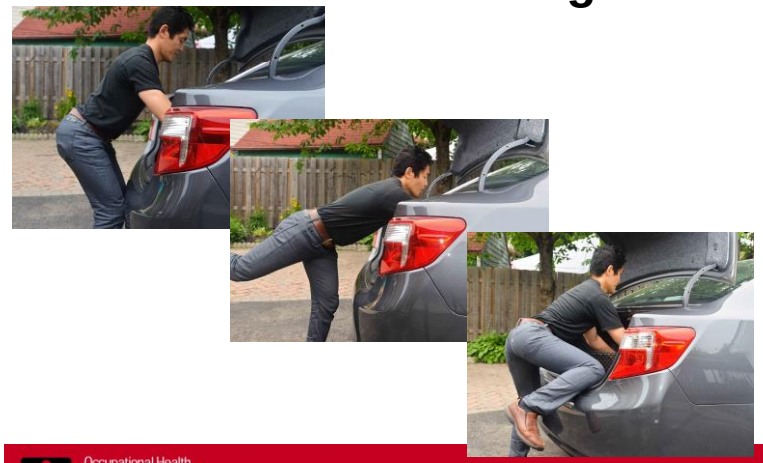
Manual Handling



Selecting a Vehicle
(CCOHS)

- Does it match requirements for the body size of the driver(s) & any physical limitations
- Do the layout & ergonomic features of the vehicle meet your needs?
- How much time per day does the driver use the vehicle and what distance do they drive per year?
- Does it have features that assist in the kind of work the driver does – eg. Easy to load trunk (salesperson)

Ideal Car/Cab Design

- Adjustable seat back incline (100-110^{o})
- Adjustable seat bottom depth, height and incline
- Seat cushion with firm (dense) foam
- Adjustable lumbar support (V & H)
- Adjustable bilateral arm rests
- Adjustable head restraint

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Car Seat Design – cont…

- Seat shock adsorbers to dampen frequencies between 1 – 20 hz.
- Linear front-back seat travel to allow differently sized drivers to reach the pedals
- Seat back damped to reduce rebounding of the torso in rear-end impacts

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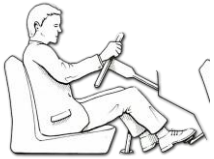
Car features: Seat Base

- Adequate leg length
  - Ensure thighs are adequately supported
    - Picture A – too short
    - Picture B – too long



A

- Adequate height adjustment
  - Feet can operate pedals without stretching
  - All controls are easily reached
  - All display instruments can be seen
  - Good all round vision

B

Car features: Back Rest

- Ensure the height of the back rest reaches the shoulders and does not obstruct 'rearward vision'

- Ensure the back rest width is enough to support the shoulders

Car features: Steering Wheel

- Adjustable steering wheel – in/out, up/down and tilt
- Power steering
- Centrally positioned and not 'off-set' to prevent rotation of the spine
- Ensure steering wheel does not obstruct the display panel
- Tilt so airbags are pointed at chest not head/face

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Steps to Injury Prevention

- Learn how to get in and out of vehicle
- Use a good sitting posture – use lumbar support
- If possible, tilt the seat a notch or two back and forth every 20-30 minutes – alters the direction of vibration
- Adjust the steering wheel – ensure you can press the pedals without moving your low back off the back of seat
- Avoid slouching
- If possible, change positions while driving
- Adjust your headrest
- Try to take regular rest/stretch breaks.Only 5 minutes will suffice

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Ideal driving posture

- Foot fully on pedal
- Back not coming off seat to push pedal

- Knees in line with hips
- flat distribution of pressure with leg on seat
- 2-3 fingers space between edge of seat and lower leg
- 20-30 degree knee angle

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Ideal driving posture cont..

- Seat tilt at 100-110 degrees
- lumbar support in lumbar curve
- upper back against seat

- Arms close to sides
- Wheel 10-12 inches away
- Elbows slightly bent
- 9 and 3 positions with both hands on wheel

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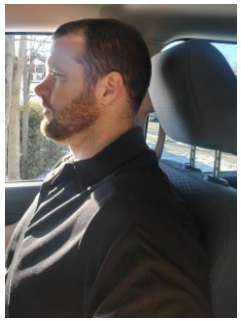
Ideal driving posture cont..



- Head 3 inches above wheel
- Ear in line with collarbone
- Head 1 inch from head restraint
- Back of head in middle of HR

The best posture is the next posture!

Working from your vehicle

- Census wide survey showed 1 in 10 are regularly working from vehicle
- Working from a vehicle can entail use of a laptop, general paperwork, mobile use or manual handling.
- Taking calls in the car for privacy and solitude

Possible issues working in car

- Static and awkward postures
- Twisting and leaning to one side
- Leaning forward
- Slouching
- Cramped positions
- Lack of adjustability

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What is the optimal way to work?




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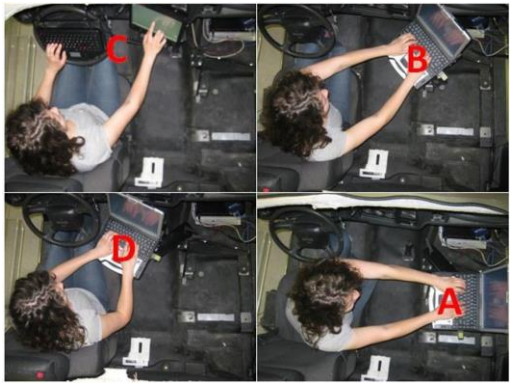
Best location for a computer



- **A & B** – poor body postures & increased muscle strain
  - Increased muscle fatigue
  - Increased risk of low back pain
  - Increased risk of shoulder MSDs

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Devices for laptop use

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Working Postures

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Working out of passenger or back seat?

- Useful if needing more room
- Avoids twisting to use laptop/computer
- However, seating generally not as adjustable, especially in back seats.
- May be restricted by equipment
- Change it up if possible

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Organization helps

- Extreme awkward postures can happen while searching for scattered documents
- Safety issues if items are not secured
- Mental stress from clutter, time loss
- Consoles with molded in file hangers and reconfigurable compartments.
- Customize it to fit the way you work
- Do not place items in an area that would restrict vision while driving
- Non-skid surfaces

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Using new technology

- Voice activated systems
  - Place calls, listen or answer texts, enter destinations, browse media and control other functions by voice. Use the cars sound system
  - No need to look at a screen
    - Is this still safe?
- Voice to text for typing
  - Google docs / Microsoft 365 voice to text software
- Touch screens – useful but do not attempt long typing sessions
- External keyboard and mouse

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Cell Phone Use

- Bluetooth
- Hands-free car kit

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Using new technology cont..

- Wifi/signal boosters connected to vehicles – laptops, passenger phones, works outside of vehicle
- Remote start, door unlocks – FOBs or cellphone activate
- Plug in power converters

- Setup systems BEFORE driving

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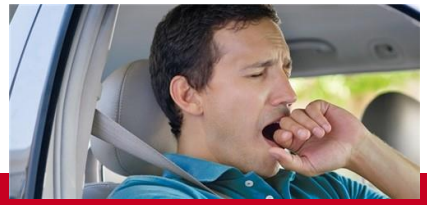
Human Factors & Driving

- Speeding
- Fatigue
- Distracted Driving



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Speeding

- Safety features can be breached once drivers pass certain speed thresholds
  - Antilock braking systems (ABS)
  - Brake assist
  - Electronic brake-force distribution (EBFD)
  - Electronic stability control (ESC)

Fatigue

- Fatigue can be experienced for a variety of reasons:
  - Inadequate sleep
  - Alcohol / Marijuana / medications
  - Prolonged hours driving
  - Time of day

How does Fatigue affect Safety

- At risk for 'nodding off' at the wheel
- Slower reaction times
- Reduced overall attention
- Slower decision-making
- Delayed information processing
- Fatigued drivers not very good at gauging their own fatigue level
- Car safety features become ineffective (similar to speeding)

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Distracted Driving

- Transport Canada
  - Fatal collisions where distraction is cited as cause have risen by 17% in Canada from 302 deaths to 352 from years 2006-2010
  - Studies estimate that distracted driving accounts for 30-80% of collisions – cellphone use

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Distracted Driving (CAA)

- Cell phones are the most common distraction
- Texting – 23 times more likey to be involved in a crash or near crash event compared with non-distracted drivers
- 84% of distracting-driving-related fatalities in US were tied to the general classification of careless or inattentiveness
- 80% of collisions and 65% of near crashed have some form of driver inattention as contributing factors

Distracted Driving (CAA)

- Distracted drivers are 3 times more likey to be in a crash than attentive drivers
- Driver distraction is a factor in about 4 million MVA in North America
- Children are 4X more distracting than adults as passengers – infants are 8X

Brain on Board: Your brain is your vehicle's most important safety feature

http://brainonboard.ca/myths_and_misconceptions/

Thank You

If you have any questions about this presentation, please contact me at the email below

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Special thanks to **Brenda Mallat**