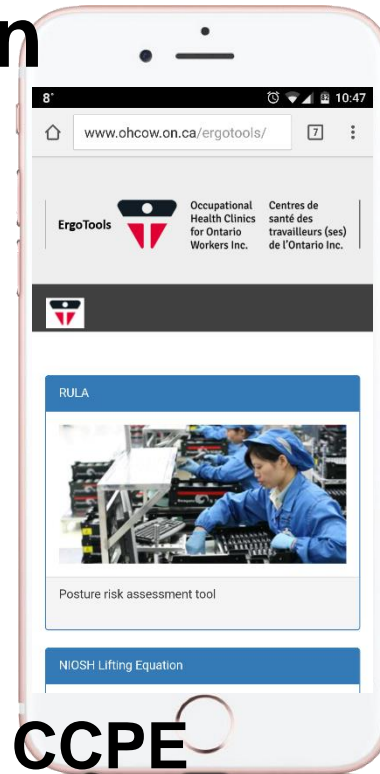
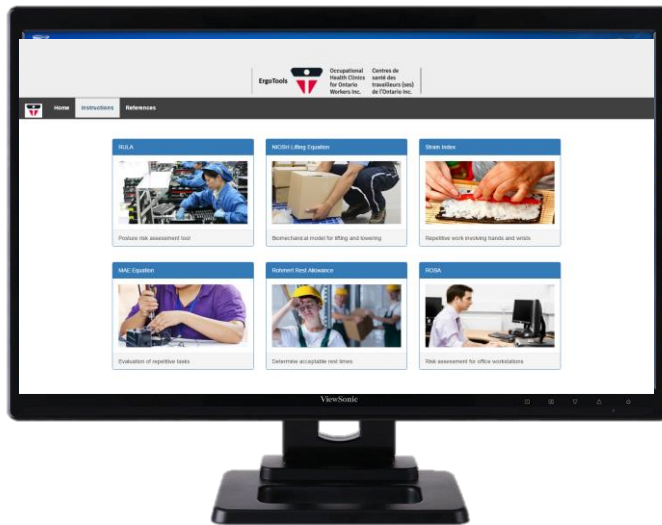


# ErgoTools: Desktop and Mobile Applications for MSD Prevention



**Mike Sonne, PhD, CCPE**

*Ergonomist*

Occupational Health Clinics for Ontario Workers,  
Hamilton, ON



Occupational Health  
Clinics for Ontario  
Workers Inc.

# What is an MSD?

- Your body is made up of muscles, tendons, nerves, joints, spinal discs and other tissues. This is the **musculoskeletal system**.
- When you injure a part of this system as a result of particular workplace hazards it is called a **Musculoskeletal Disorder** or **MSD**.



Image Source: Istockphoto.com



# The Most Common Type of Injury in Ontario

- Cost Ontario workplaces **\$1.2 Billion** per year
- MSDs **account for 44% of injuries** where a worker missed work
- **Preventing MSDs** means more employees **go home healthy and safe** at the end of the day

**\$1.2  
Billion**

**44%**



# MSD Hazards

Duration

Temperature  
(hot or cold)

Force

Organization

Contact  
Stress

Repetition

Awkward/Fixed  
Posture

Vibration



# Ergonomics Tools

Pen and Paper

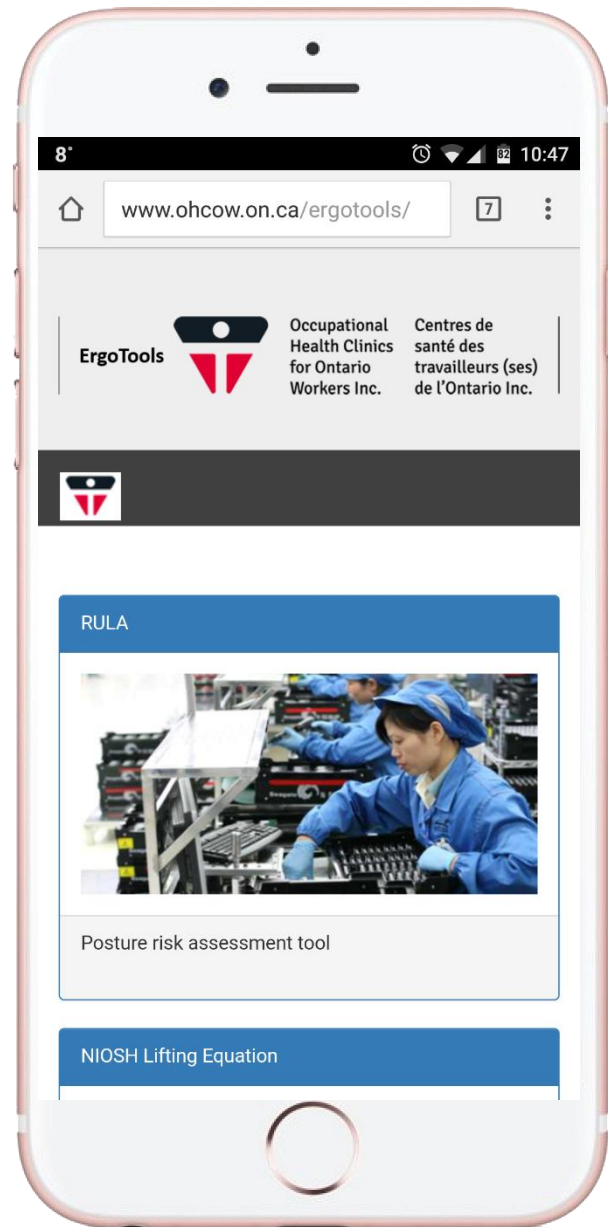


Desktop Only



# Presenting: ErgoTools!

- Combination of 6 commonly used Ergonomics tools
  - RULA
  - ROSA
  - MAE Equation
  - Rohmert Rest Allowance
  - Strain Index
  - NIOSH Lifting Equation
- Works well on desktops, as well as cell phones and tablets
- Give a preliminary idea into if jobs are acceptable for known MSD prevention standards



# ErgoTools - Use

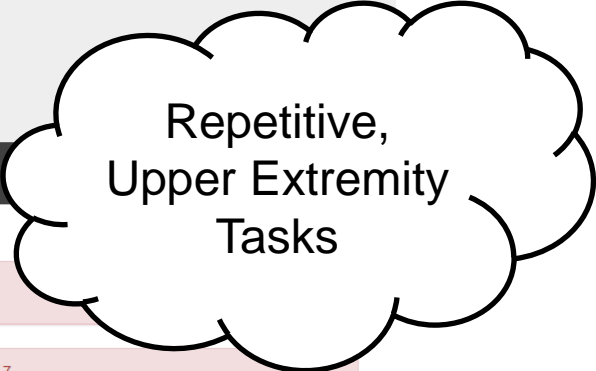
- Tools require some training – targeted at ergonomists, or JHSC members with ergo training
- Can be used to do screening assessments, and to build a database in your workplace



# Other Tools – Strain Index

ErgoTools Occupational Health Clinics for Ontario Workers Inc. Centres de santé des travailleurs (ses) de l'Ontario Inc.

Home Instructions References



Strain Index: 10.125


SI  $\leq$  3  
Job is Probably safe

SI  $>$  3,  $<$  7  
May place individual at increased risk for MSDs

SI  $>$  7  
Job is probably hazardous

## Exertion Characteristics

Intensity of Exertion



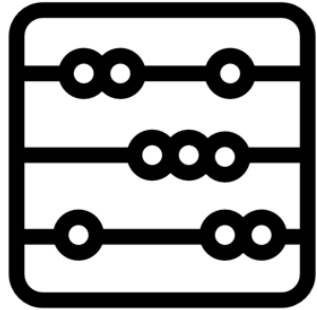
Light (Borg  $<$  2)

Duration of Exertion



$<$ 10% of cycle

Frequency of Exertions



$<$ 4 per minute



# MAE Equation

ErgoTools



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santé des  
travailleurs (ses)  
de l'Ontario Inc.

Repetitive Work  
Assessment



Home

Instructions

References

Maximum Acceptable Effort

Duty Cycle

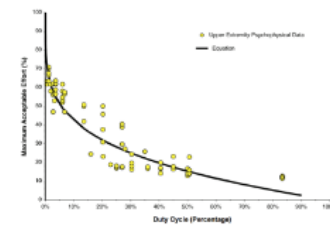
Duty Cycle:

0.34

Maximum Acceptable Effort (% of Maximum):

22.813

MAE vs DC



Back Calculate



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# RULA

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for Ontario  
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santé des  
travailleurs (ses)  
de l'Ontario Inc.



Home

Instructions

References

Postural  
Assessment

## Rapid Upper Limb Assessment

### Upper Arm Angle

20° -20°

Between -20° and 20°

20° +

Extension > than -20°

20° - 45°

Flexion between 20° and 45°

45° - 90°

Flexion between 45° and 90°

90° +

Flexion > 90°

Shoulder is Raised

Arm Abducted

Arm Supported

### Lower Arm Angle

60° - 110°

60° - 100°

0° - 60°

0° - 60°

100°+

100°+

Arm to Side/Across Midline

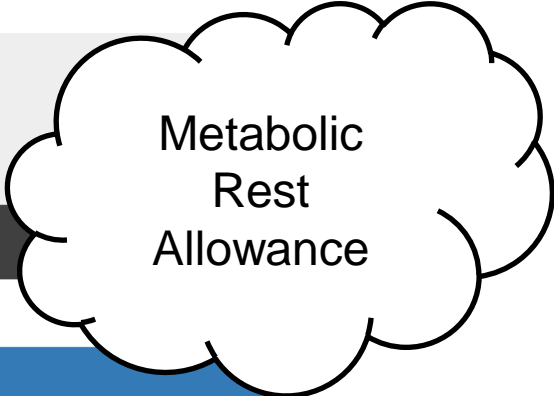



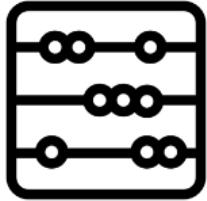


# Rohmert Rest Allowance

ErgoTools Occupational Health Clinics for Ontario Workers Inc. Centres de santé des travailleurs (ses) de l'Ontario Inc.

Home Instructions References

Rohmert Rest Allowance



 <p>Time (seconds)</p> <input type="text" value="4"/>	 <p>Efforts Per Minute</p> <input type="text" value="10"/>	 <p>Joint Moment</p> <input type="text" value="10"/>	 <p>Joint Strength</p> <input type="text" value="20"/>
--	---	---	---

The Rest Time for this task is **ACCEPTABLE**

[Back](#) [Calculate](#)

# NIOSH Lifting Equation

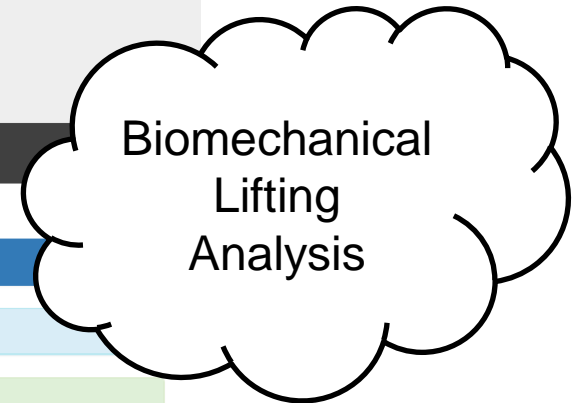
ErgoTools Occupational Health Clinics for Ontario Workers Inc. Centres de santé des travailleurs (ses) de l'Ontario Inc.

Home Instructions References

NIOSH Lifting Equation

NIOSH RWL

28.82 Kg



<p>Horizontal Reach (H)</p> <input type="text" value="15"/>	<p>Vertical Height (V)</p> <input type="text" value="0"/>	<p>Vertical Distance (D)</p> <input type="text" value="30"/>	<p>Twist Angle (A)</p> <input type="text" value="0"/>	<p>Coupling</p> <p>Good ▾</p>	<p>Frequency</p> <p>Check the table below and enter the appropriate frequency modifier below</p> <input type="text" value="1.00"/>
---	---	--	---	-------------------------------	--

Time Between Lifts	FM Factor			
	Lifting While Standing:		OR Lifting While Stooping:	
	One Hour or Less	Over One Hour	One Hour or Less	Over One Hour
5 min	1.00	0.85	1.00	0.85

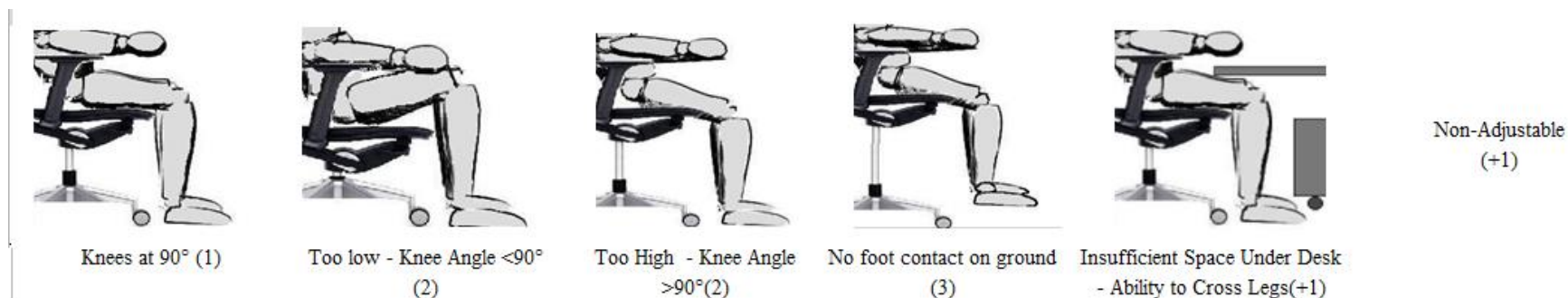
# ErgoTools - ROSA

- The Rapid Office Strain Assessment – Allows a quick evaluation of the office workstation, provides a 1-10 scale representing risk level (10 is higher)



# ROSA - Development

- Risk Factors and ideal postures identified using the CSA Standards on Office Ergonomics (CSA Z412).
- Risk factors and work postures associated with chair, monitor, telephone, keyboard and mouse
  - Risk scores are assigned to each posture and posture combination as they deviate from neutral.



# Methods– Tool Development

- An total risk score can be reached (from 1-10) by comparing total chair score vs. Monitor and peripherals score.

		ROSA TOTAL SCORE									
		Peripherals and Monitor									
		1	2	3	4	5	6	7	8	9	10
Chair	1	1	2	3	4	5	6	7	8	9	10
	2	2	2	3	4	5	6	7	8	9	10
	3	3	3	3	4	5	6	7	8	9	10
	4	4	4	4	4	5	6	7	8	9	10
	5	5	5	5	5	5	6	7	8	9	10
	6	6	6	6	6	6	6	7	8	9	10
	7	7	7	7	7	7	7	7	8	9	10
	8	8	8	8	8	8	8	8	8	9	10
	9	9	9	9	9	9	9	9	9	9	10
	10	10	10	10	10	10	10	10	10	10	10

# Subjects & Procedure

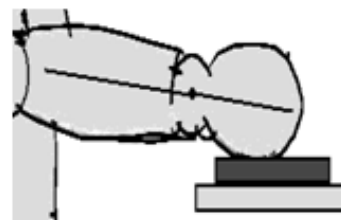
- 72 Office Workers were recruited from a local hospital's administrative staff.
- Each workstation was assessed using ROSA.
- Each worker completed a discomfort questionnaire (Hedge et al., 1999).





# Methods - Procedure

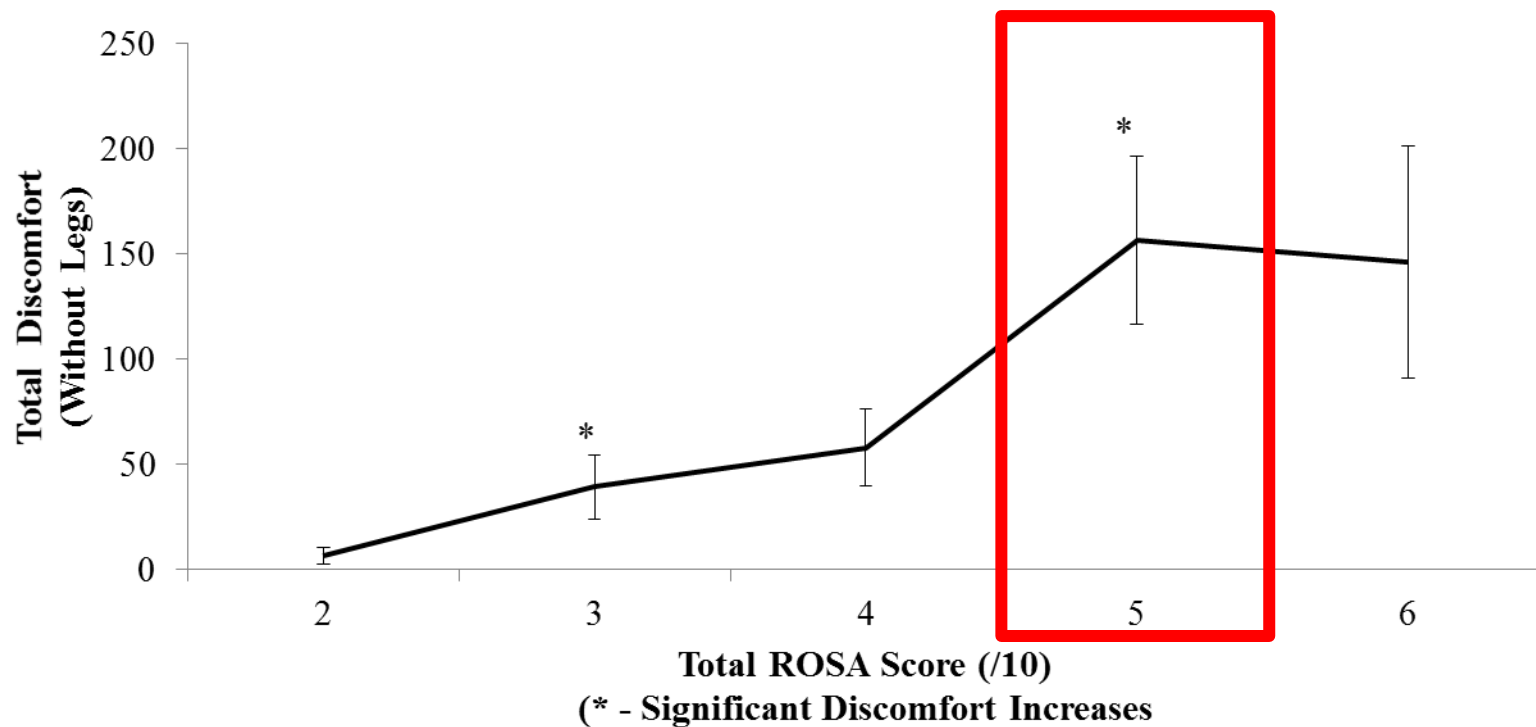
- Inter-rater reliability:
  - 3 Trained observers assessed 14 workstations simultaneously.
- Intra-rater reliability:
  - 3 trained observers assessed workstations once a week for 4 weeks.



Wrists Straight, Shoulders  
Relaxed (1)

# Results

- Inter-rater reliability - ICC=.91 (average)
- Intra-rater reliability - ICC=.88 (average)



# Conclusions

- Using a value of 5 as a cut-off for immediate action may allow professionals to focus on high-risk offices, reducing risk of lost time injuries.



Development and evaluation of an office ergonomic risk checklist:  
ROSA – Rapid office strain assessment

Michael Sonne<sup>a,b</sup>, Dino L. Villalta<sup>b</sup>, David M. Andrews<sup>a,\*</sup>

<sup>a</sup>Department of Kinesiology, University of Windsor, 401 Sunset Avenue, Windsor, Ontario, Canada N9B 3P4

<sup>b</sup>LeadErgonomics, Tecumseh, Ontario, Canada



# Purpose

Experimental Validity Confirmed if:

1. No significant differences between measures
2. Measures were correlated with a magnitude of greater than  $r=0.5$  (Moderate – Vincent, 1999)



# Methods

## The Rapid Office Strain Assessment - ROSA

Tracking Menu

Michael Sonne, MHK Candidate, CK.

You Are Logged In As: **testaccount**  
 You Logged in at: **Sun, April 18, 6:22 pm**

[Log Out](#)



**My Profile**

- Chair
  - Height
  - Depth
  - Arm Rests
  - Back Rest
  - Duration

Monitor

Telephone

Mouse

Keyboard

Discomfort  
Questionnaire



Knees at 90 Degrees



Insufficient space under desk - Can't cross your legs

**Video Library**



Chair too low - Knee angle < 90 degrees



Height non-adjustable

**Resources**



Chair too high - Knee angle > 90 degrees

Next - Seat Pan Depth

**Additional Info**



Chair too high - No foot contact with ground

Fixed Scores

Additive Scores

Copyright 2010 Michael Sonne

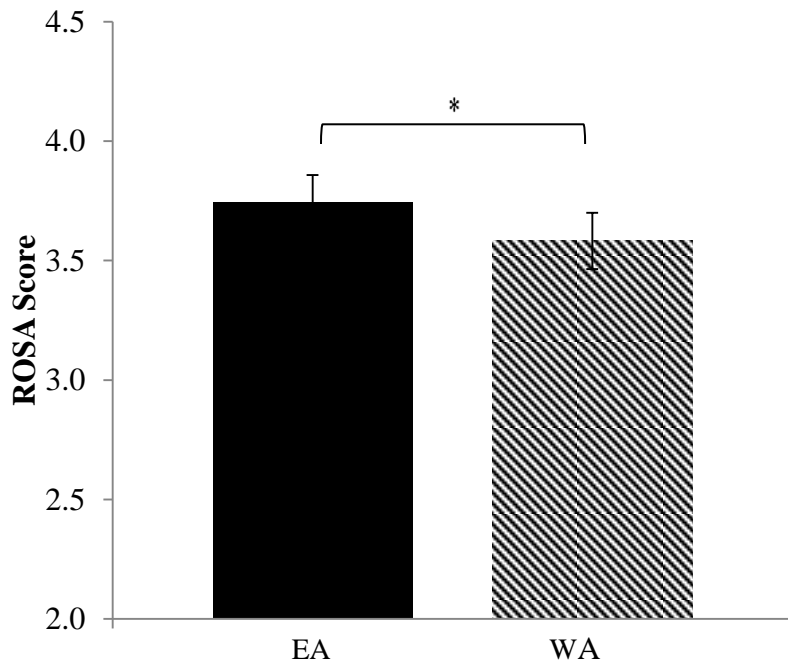


Video on Assessment

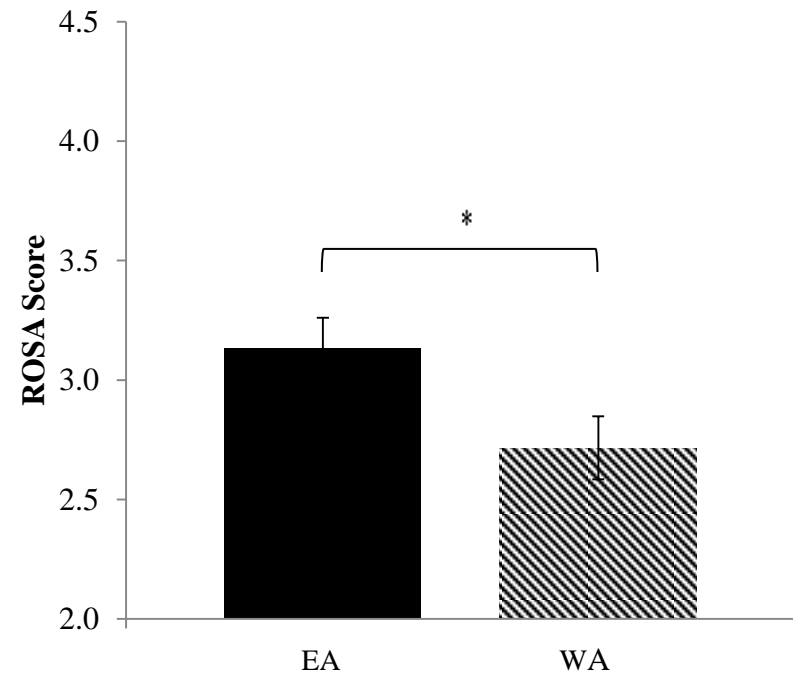


# Results – Assessment Type

## ROSA Final Scores



## Mouse and Keyboard Scores



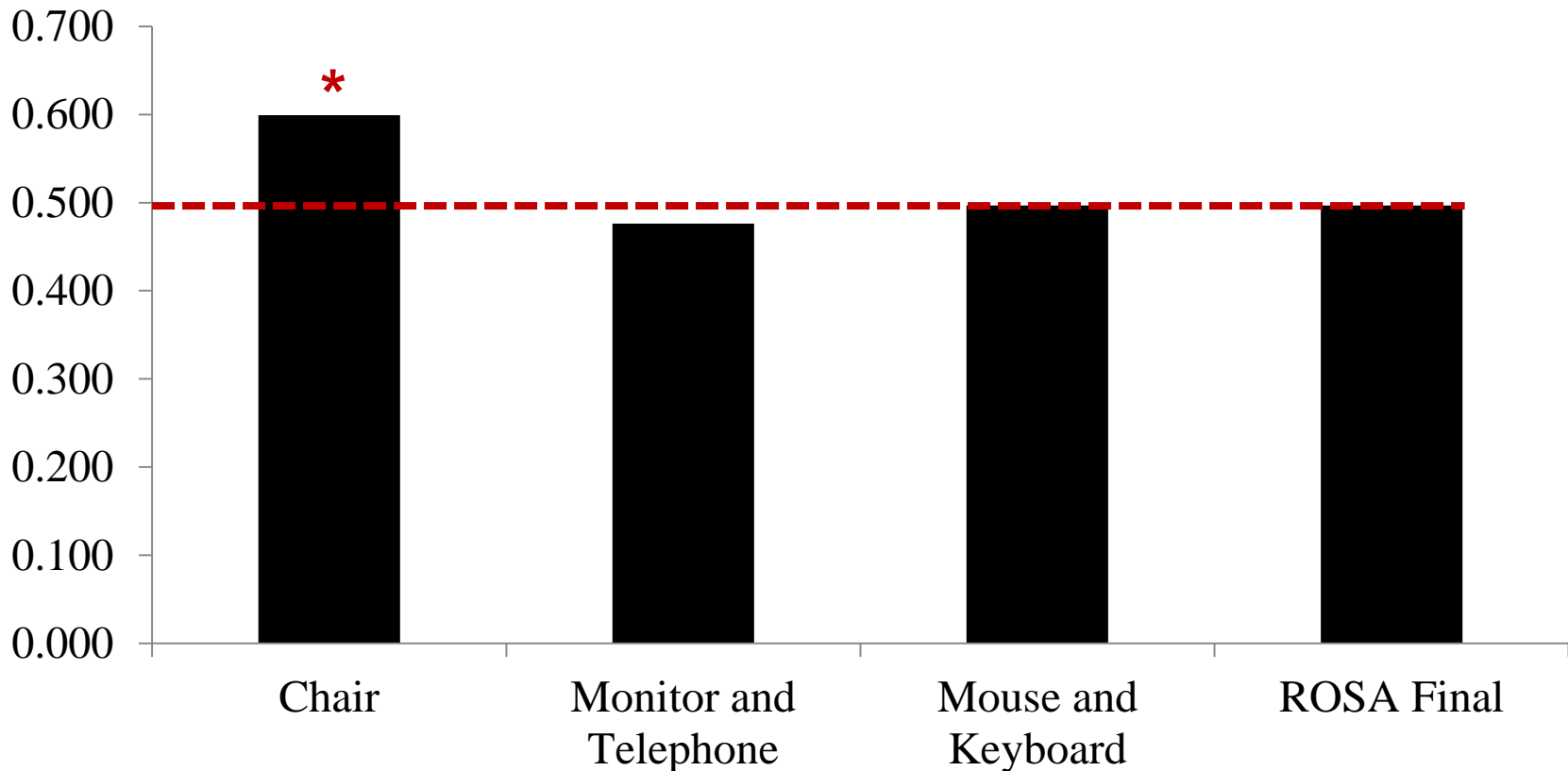
# Results – Assessment Type

- No main effect seen for Assessment Type in the Chair, or Monitor and Telephone subsection
  - Chair
    - EA = mean 3.36 (SE(0.12)), WA = 3.02 (0.13)
  - Monitor and Telephone
    - EA = 2.74(0.16), WA = 2.54(0.15)



# Results – Assessment Type

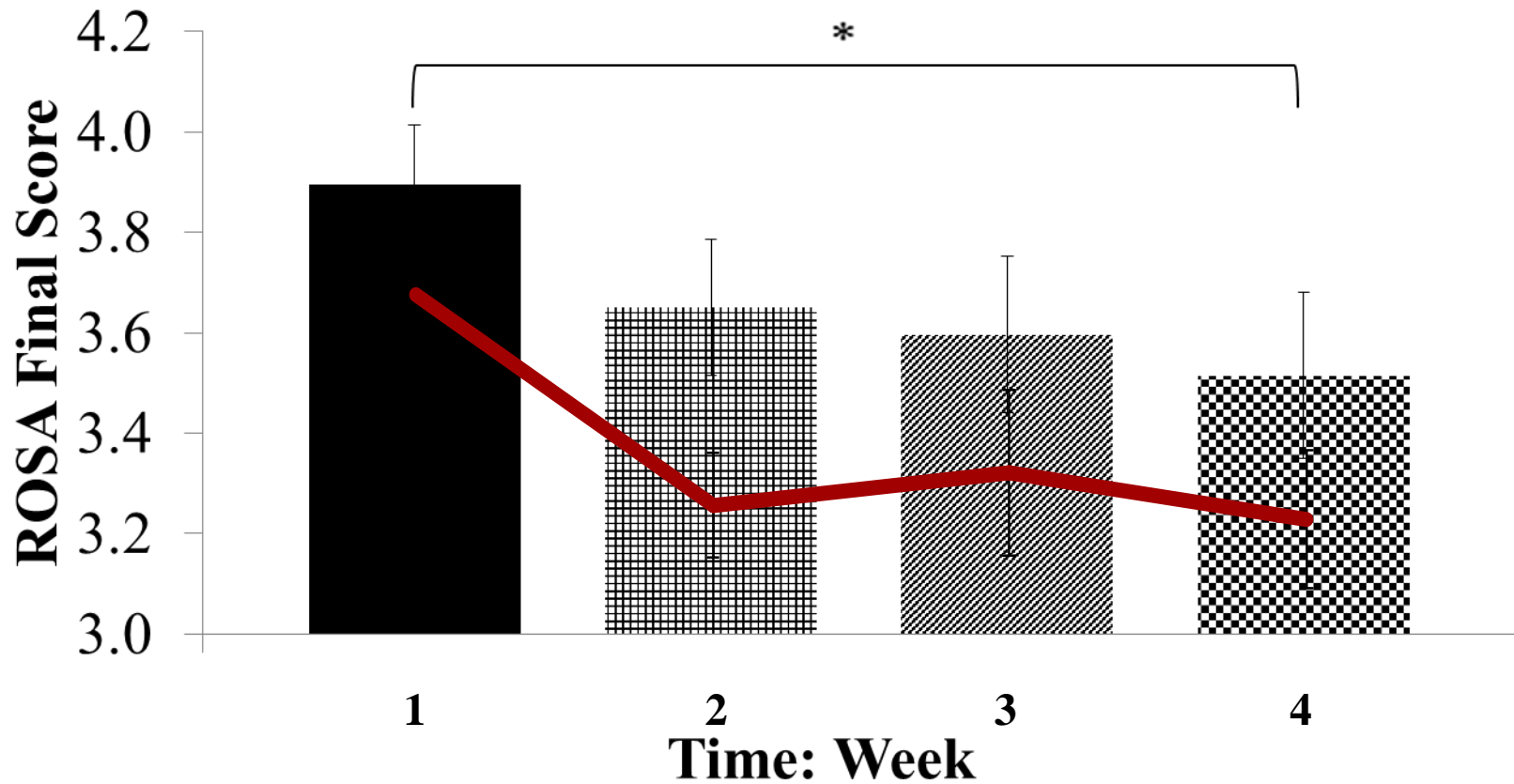
- Correlations between WA and EA





# Results

## ROSA Final Scores



# Conclusions

- Observer-reported ROSA final scores require additional study
  - Observer-reported ROSA scores from chair met the experimental definition of Validity
  - Correlation strength increased from Week 1 to 4 in Mouse and Keyboard and ROSA final section
- Feedback had a detrimental effect on worker assessment performance

Occupational Ergonomics 10 (2011/2012) 83–101  
DOI 10.3233/OER-2012-0194  
IOS Press

83

**The Rapid Office Strain Assessment (ROSA):  
Validity of online worker self-assessments  
and the relationship to worker discomfort**

Michael Sonne<sup>a,b,\*</sup> and David M. Andrews<sup>c</sup>

<sup>a</sup>Department of Kinesiology, McMaster University, Hamilton, Ontario, Canada

<sup>b</sup>LeadErgonomics Consulting Services, Windsor, Ontario, Canada

<sup>c</sup>Department of Kinesiology, University of Windsor, Windsor, Ontario, Canada



# Other Methods for ROSA

- Research Question: Is photo-analysis a valid method of office workstation risk factor assessments using ROSA?

Applied Ergonomics 52 (2016) 317–324

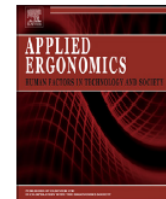


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Contents lists available at [ScienceDirect](#)

Applied Ergonomics

journal homepage: [www.elsevier.com/locate/apergo](http://www.elsevier.com/locate/apergo)



Photograph-based ergonomic evaluations using the Rapid Office Strain Assessment (ROSA)

J. Liebrechts, M. Sonne\*, J.R. Potvin

Department of Kinesiology, McMaster University, 1280 Main St. W, Hamilton, Ontario L8S 4L8, Canada



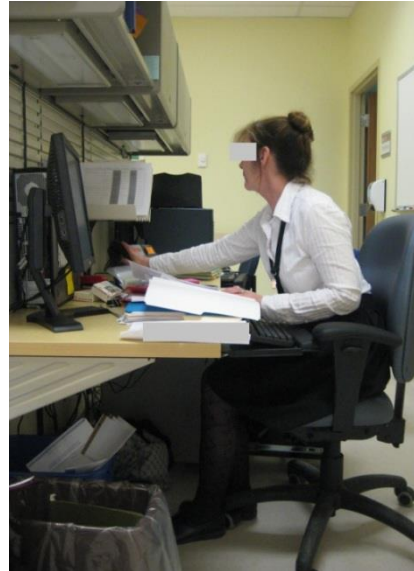
Occupational Health  
Clinics for Ontario  
Workers Inc.

# Methods

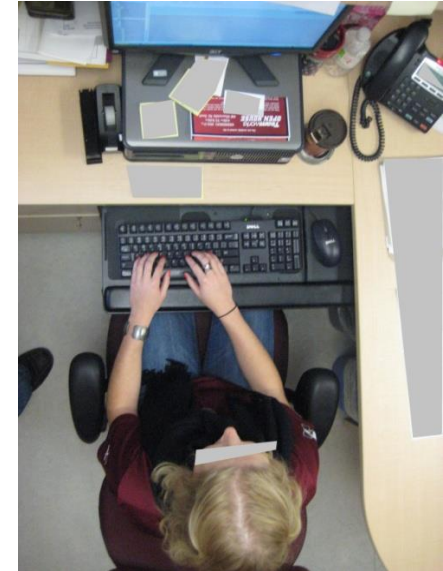
## Photographs:



**Fig. 2.** Fully inclusive sagittal photo – trunk, seat properties, upper limb, neck, equipment orientation



**Fig. 3.** Sagittal photo capturing reach for telephone



**Fig. 4.** Coronal photo showing upper limb postures while typing, neck rotation



# Methods

## Photographs:



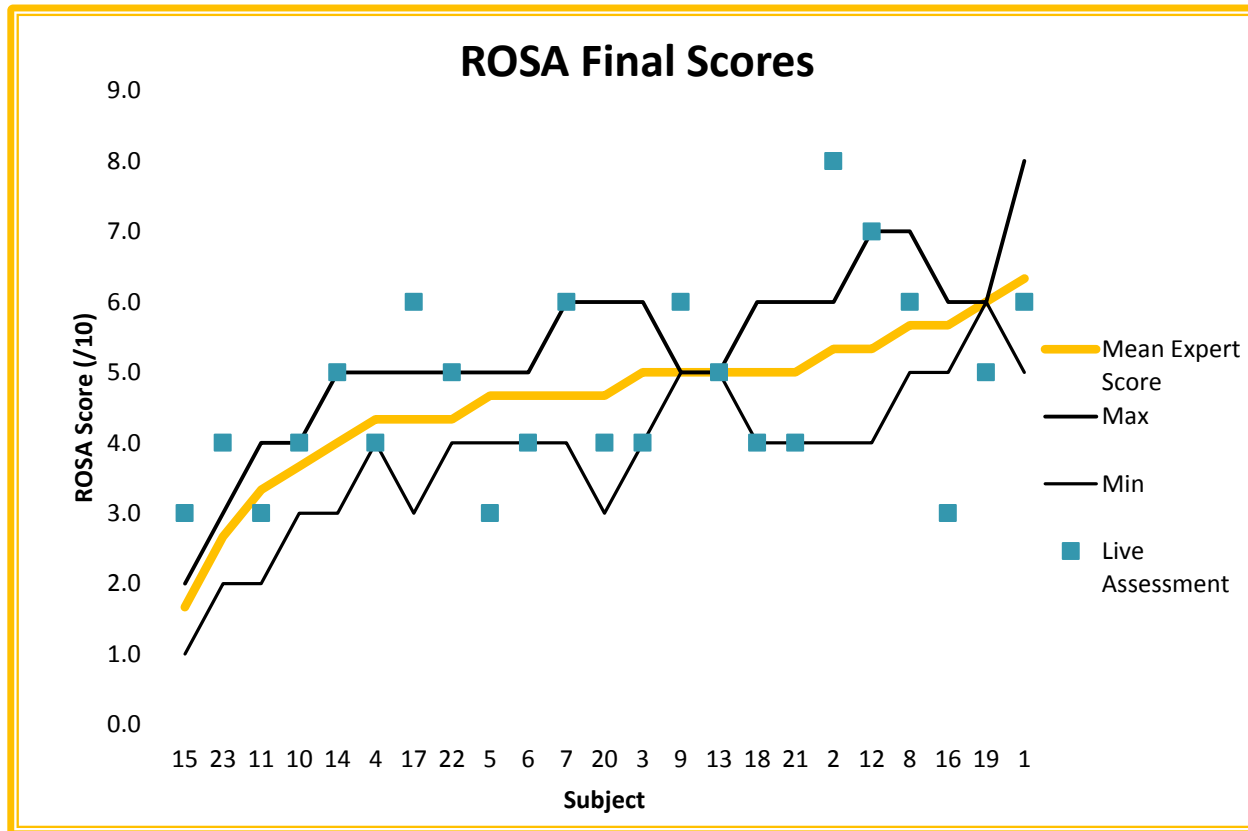
**Fig. 5.** Photo capturing the workstation operator's phone usage



**Fig. 6.** Coronal photo depicting upper limb postures while mousing



# Results



**Fig. 7.** Overall relationship between live assessments and photo-observer scores



بخش A: صندلی  
ارتفاع صندلی

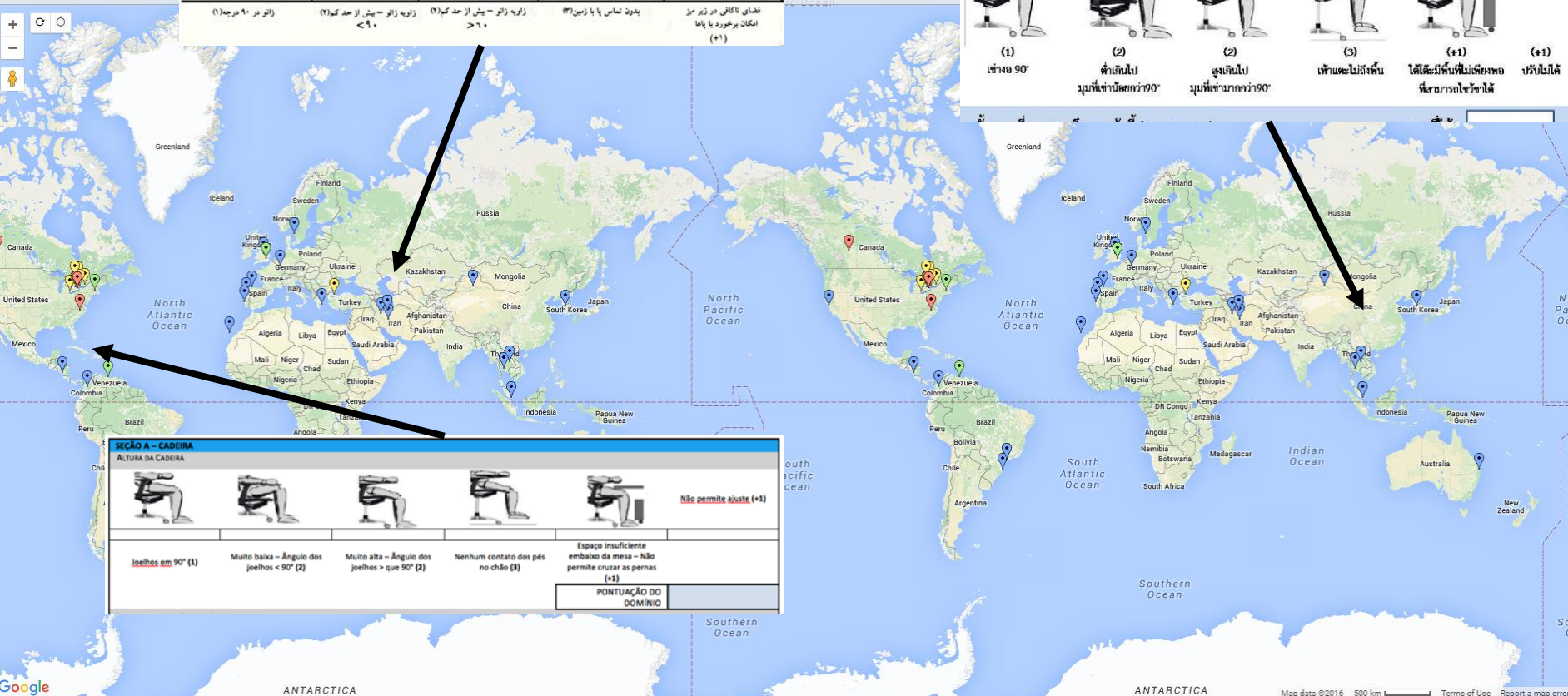
(1) زانو در 90 درجه	(2) زاویه زانو - پیش از حد کم (90 <)	(3) زاویه زانو - پیش از حد کم (90 >)	(4) بدون تماس پا با زمین (0)	فضای ناگفتی در زیر میز امکان برخورد پا با میز (+1)
---------------------	--------------------------------------	--------------------------------------	------------------------------	--

گروه A کارویکرانه گای (Chair)

بخش 1: ارتفاع صندلی (Chair Height) کنترل:

(1) เข่า 90°	(2) ต่ำเกินไป มุมเข่าน้อยกว่า 90°	(2) สูงเกินไป มุมเข่ามากกว่า 90°	(3) เท้าและมือถึงพื้น	(+1) ได้สัมผัสพื้นที่ไม่ต้องงอข้อศอกที่สามงอไขว้ขาได้	(+1) ราบไม่ได้
--------------	-----------------------------------	----------------------------------	-----------------------	---	----------------

Where in the World is ROSA?



SEÇÃO A - CADEIRA  
ALTURA DA CADEIRA

Joelhos em 90° (1)	Muito baixa - Ângulo dos joelhos < 90° (2)	Muito alta - Ângulo dos joelhos > que 90° (2)	Nenhum contato dos pés no chão (3)	Espaço insuficiente embaixo da mesa - Não permite cruzar as pernas (+1)
PONTUAÇÃO DO DOMÍNIO				

ROSA is an easy to use tool for assessing office ergonomics. It is used all around the world, and here's where!

Chair Height

Select **ONE** of the following

Select one of these options



Knees are at 90°



Chair too low - Knee angle < 90°



Chair too high - Knee angle > 90°



Chair too high - No foot contact with ground

Select **ANY** of the following

Select any of these options



Insufficient space under desk - Can't cross your legs



Height non-adjustable




# Chair Depth


## Rapid Office Strain Assessment

### Chair Depth


Select **ONE** of the following



2-3" (one fist) between edge of chair and knee



Seat Pan Too Long



Seat Pan Too Short

Select **ANY** of the following




Chair Depth Non-Adjustable

Back Next


## Rapid Office Strain Assessment

### Arm Rests


Select **ONE** of the following



Elbows are supported at 90°. Shoulders are relaxed.



Armrests are too high



Armrests are too low

## Rapid Office Strain Assessment

### Back Rest

Select **ONE** of the following



Adequate Lumbar Support - Seat Recline is between 95-110 degrees



No Lumbar Support OR lumbar support not positioned in the small of the back



Angled too far back (greater than 110 degrees) OR angled too far forward (less than 95 degrees)



No Back Support (leaning forward, or using a stool)

Select **ANY** of the following



The work surface is too high, causing the shoulders to be shrugged.



The Backrest is not adjustable

Chair Use Duration

I use the chair less than 1 hour per day

I use the chair between 1 to 4 hours per day

I use the chair more than 4 hours per day

Back Next



# Monitor

Rapid Office Strain Assessment

Monitor

Select **ONE** of the following



The top of the monitor is slightly below eye level, the head is in a neutral posture while viewing the screen.



The monitor is too low (greater than 30 degrees below eye level), causing the head to be tilted forward.



The top of the monitor is higher than eye level, causing the head to be tilted backwards.



The monitor is too far away (greater than an arm's length)

Select **ANY** of the following



The monitor is positioned to the side of the desk creating neck rotation of greater than 30 degrees



Glare is on the monitor which may contribute to eye fatigue



Documents are being used without a document holder



One more of the monitor items were not adjustable

Monitor Use Duration

I use the monitor less than 1 hour per day

I use the monitor between 1 to 4 hours per day

I use the monitor more than 4 hours per day

[Back](#) | [Next](#)





# Telephone



Rapid Office Strain Assessment

Telephone

Select ONE of the following

 <input type="radio"/> The Telephone is used by headset or is held in one hand during use.	 <input type="radio"/> Neck and Shoulder hold is used during phone use.
---	--

Select ANY of the following

 <input type="checkbox"/> The Telephone is greater than a 30cm reach from the chair (greater than an arm's length)	 <input type="checkbox"/> There are no handsfree options available.
---	--

Telephone Use Duration

<input type="radio"/> I use the telephone less than 1 hour per day	<input type="radio"/> I use the telephone between 1 to 4 hours per day	<input type="radio"/> I use the telephone more than 4 hours per day
---	---	--

Back Next



# Mouse

## Rapid Office Strain Assessment

### Mouse

Select **ONE** of the following



Mouse in line with the shoulder, wrist straight while using the mouse



Mouse positioned to the side - arm is not close to the body and is reaching to the mouse

Select **ANY** of the following



Mouse and keyboard are located on two different surfaces causing increased reaching to the mouse.



Pinch Grip on the Mouse - mouse does not sit in the palm of the hand



Hard Palm Rest in front of the mouse



One or more of the mouse-related items were not adjustable

### Mouse Use Duration

I use the mouse less than 1 hour per day

I use the mouse between 1 to 4 hours per day

I use the mouse more than 4 hours per day

[Back](#) | [Next](#)



# Keyboard

Rapid Office Strain Assessment

Keyboard

Select **ONE** of the following



Wrists straight while typing



Wrists extended while Typing

Select **ANY** of the following



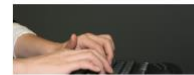
Wrist Deviation while Typing



Keyboard Tray Too High causing shoulders to be shrugged while typing



Reaching to overhead items



One or more of the keyboard items were not adjustable

Keyboard Use Duration

I use the keyboard less than 1 hour per day

I use the keyboard between 1 to 4 hours per day

I use the keyboard more than 4 hours per day

[Back](#) [Next](#)



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santé des  
travailleurs (ses)  
de l'Ontario Inc.

## Rapid Office Strain Assessment

### ROSA Scores

ROSA Final Score

**7**

ROSA Chair Score

**6**

ROSA Monitor and  
Telephone Score

**6**

ROSA Mouse and  
Keyboard

**5**

[Do another ROSA Assessment](#)



# ErgoTools - ROSA

- Scores of 5 or greater – ↑ Discomfort
- Have an Ergonomics Assessment completed

The screenshot shows the ErgoTools ROSA assessment results page. At the top, there is a header with the ErgoTools logo and the text "Occupational Health Clinics for Ontario Workers Inc." and "Centres de santé des travailleurs (ses) de l'Ontario Inc.". Below the header is a navigation bar with "Home", "Instructions", and "References" links. The main content area features a blue bar for "Rapid Office Strain Assessment" and a light blue bar for "ROSA Scores". The scores are displayed in four boxes: "ROSA Final Score" (5), "ROSA Chair Score" (4), "ROSA Monitor and Telephone Score" (5), and "ROSA Mouse and Keyboard" (3). At the bottom, there is a green bar with the text "Do another ROSA Assessment".

ROSA Final Score	ROSA Chair Score	ROSA Monitor and Telephone Score	ROSA Mouse and Keyboard
5	4	5	3

Do another ROSA Assessment

# ROSA - Reporting

ROSA Final Score	ROSA Chair Score	ROSA Monitor and Telephone Score	ROSA Mouse and Keyboard
5	4	3	5

The recommendations made based on your ROSA assessment come from the Canadian Standards Association guidelines on office ergonomics (CSA Z412). OHCOW has produced a detailed guideline for setting up your office workstation, and recognizing the risk factors associated with MSDs in the office. **You can download that document [here](#).**

The set up of your office is key to improving your comfort while you work on the computer. However, even a "perfect posture" will lead to discomfort if it is held for a long enough period of time. It is recommended that you take stretch breaks, at least once an hour, to improve your comfort. OHCOW has produced a guideline for stretching in the office **which you can find [here](#).**

## ROSA Report

### Chair

Assessment	Recommendations
The chair height is too high. The knee angle is greater than 90°, and there is pressure on the underside of the thigh.	Pull up on the lever for chair height, and place your weight in the seat pan. Lower the chair until the knees are at 90°. If you can not get the seat pan low enough to do this, use a footrest.
There was insufficient space under the desk, and equipment was contacting the legs. This prevents the computer user from getting into the appropriate position to use their computer.	Have the computer tower moved to the desk surface, or away from the legs. If there is a keyboard tray mechanism, adjust it so that the tray does not hit the legs.
There is less than 2-3" of space between the front of the seat pan and the back of the knees. This indicates that the seat pan depth is too long.	Slide the seat pan depth adjustment to allow for 2-3" of space between the front edge of the chair and the back of the knees.





# ErgoTools – ROSA

- Excel Worksheet

Workstation / Worker	A	B	C	D	E	F	G
1							
2	Mike Sonne						
3	OHCOW worker #1						
4	OHCOW worker #2						
5							
6							
7							
8							
9							
10							
11							

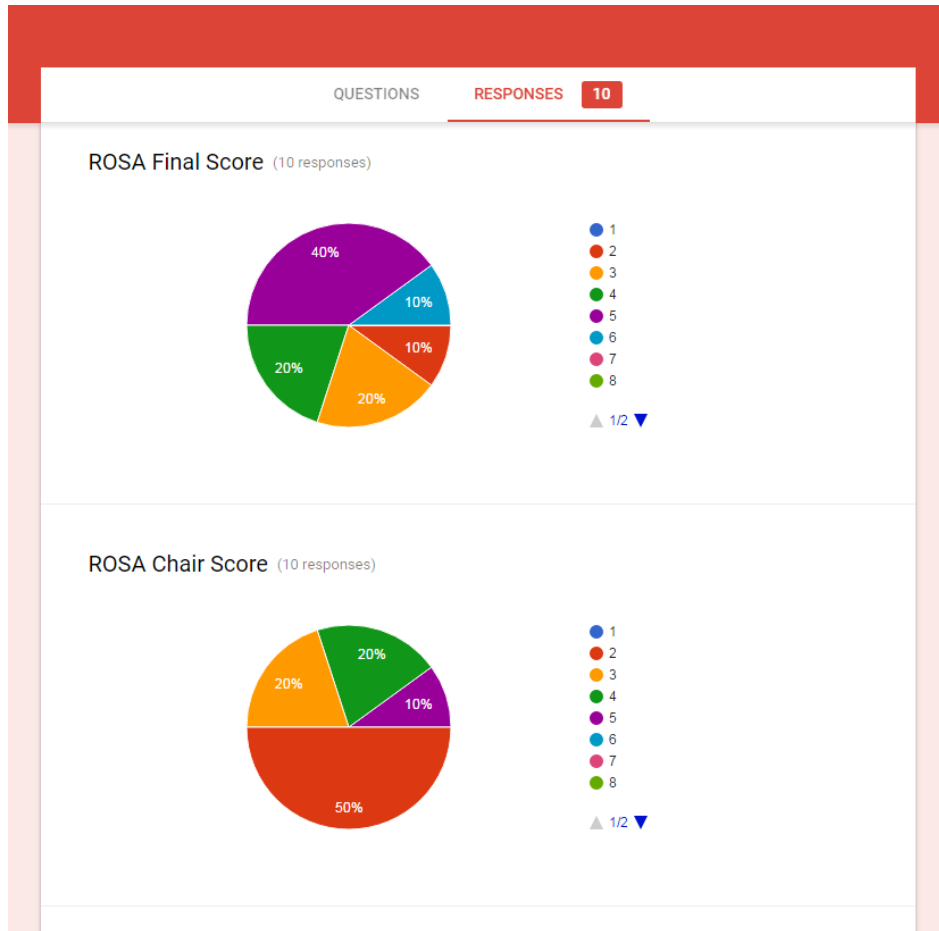
  

	ROSA Final Score	Chair Score	Monitor / Telephone Score	Mouse / Keyboard Score
<b>Average Scores</b>	4.7	4.0	2.7	2.7

	ROSA Final Score	Chair Score	Monitor / Telephone Score	Mouse / Keyboard Score	RANK
<b>Highest ROSA Scores</b>					
<b>Name</b>					
OHCOW worker #1	6.00	4.00	2.00	4.00	1
Mike Sonne	5.00	5.00	4.00	2.00	2
OHCOW worker #2	3.00	3.00	2.00	2.00	3
					4
					5

# ROSA Results



# OHCOW - ErgoTools

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Occupational Health Clinics for Ontario Workers Inc.

Centres de santé des travailleurs (ses) de l'Ontario Inc.



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## Introduction to OHCOW

For over 25 years, OHCOW has been a valuable injury and illness prevention resource for the workers and workplaces of Ontario. The first clinics, proposed by the Ontario Federation of Labour (OFL)

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## Here to Help

Our clients include workers, joint health and safety committees or representatives, unions, employers, health professionals, community groups, legal clinics, students and members of the public.

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## Our Services

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## Our Locations



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## Key Programs



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Occupational Health Clinics for Ontario Workers Inc.

# OHCOW - ErgoTools

- [www.ohcow.on.ca/ergotools](http://www.ohcow.on.ca/ergotools)
  - Mike Sonne, PhD, CCPE
  - [msonne@ohcow.on.ca](mailto:msonne@ohcow.on.ca)
  - 1-877-817-0336 ext. 2232
- Thanks!

