Ergonomics – risk assessment of hand intensive repetitive work

Mikael Forsman

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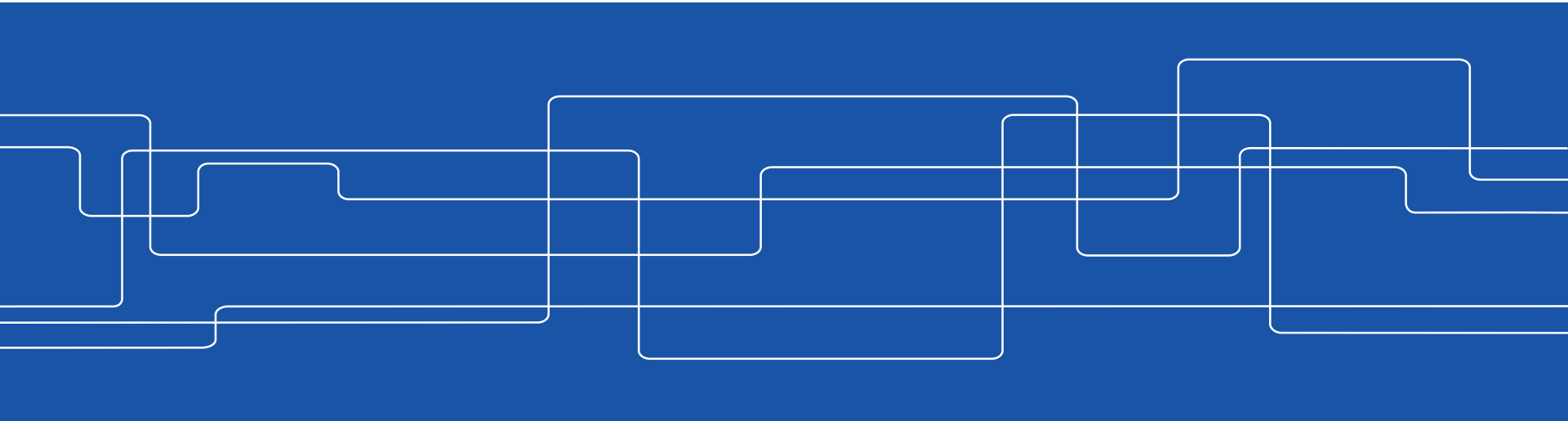

Introduction

Work-related musculoskeletal disorders and sick-leave are still frequent.

Musculoskeletal disorders constitute 40% of global compensation costs of occupational and work-related injuries and diseases.

Work-related musculoskeletal disorders are the most frequent occupational diseases In the European Union.

Work postures, work movements, physical loads, repetitive tasks and psychosocial conditions are risk factors.

Hand intensive work

New provisions from the Swedish Work Environment Authority, states that all employees with hand intensive tasks should be offered medical controls.

- Rapid sustained wrist movements against the outer positions of the joint in combination with force
- However, this does not apply if an in-depth assessment shows that the work does not provide an increased risk of strain problems in the neck, shoulder, arm or hand.

Interventions

The basic intervention phases are:

- problem identification – risk assessment
- idea and solution development
- implementation

What may happen if non-reliable methods are used for risk assessments?

- Risks may be unidentified
- Non-risks may be seen as risks
- Risks of different work moments may be erroneously ranked
- Intervention evaluations may be wrong

Technical methods

Observational methods

HAL, RULA, QEC, STRAIN INDEX, KIM, …

Observation Method Example - Quick Exposure Check (QEC)

Observer's Assessment

Back

A **When performing the task, is the back**
(select worse case situation)

- A1 Almost neutral?
- A2 Moderately flexed or twisted or side bent?
- A3 Excessively flexed or twisted or side bent?

B **Select ONLY ONE of the two following task options:**

EITHER

For seated or standing stationary tasks. Does the back remain in a static position most of the time?

- B1 No
- B2 Yes

OR

For lifting, pushing/pulling and carrying tasks (i.e. moving a load). Is the movement of the back

- B3 Infrequent (around 3 times per minute or less)?
- B4 Frequent (around 8 times per minute)?
- B5 Very frequent (around 12 times per minute or more)?

Shoulder/Arm

C **When the task is performed, are the hands**
(select worse case situation)

- C1 At or below waist height?
- C2 At about chest height?
- C3 At or above shoulder height?

D **Is the shoulder/arm movement**

- D1 Infrequent (some intermittent movement)?
- D2 Frequent (regular movement with some pauses)?
- D3 Very frequent (almost continuous movement)?

Worker's Assessment

Workers

H **Is the maximum weight handled MANUALLY BY YOU in this task?**

- H1 Light (5 kg or less)
- H2 Moderate (6 to 10 kg)
- H3 Heavy (11 to 20kg)
- H4 Very heavy (more than 20 kg)

J **On average, how much time do you spend per day on this task?**

- J1 Less than 2 hours
- J2 2 to 4 hours
- J3 More than 4 hours

K **When performing this task, is the maximum force level exerted by one hand?**

- K1 Low (e.g. less than 1 kg)
- K2 Medium (e.g. 1 to 4 kg)
- K3 High (e.g. more than 4 kg)

L **Is the visual demand of this task**

- L1 Low (almost no need to view fine details)?
- *L2 High (need to view some fine details)?

* *If High, please give details in the box below*

M **At work do you drive a vehicle for**

- M1 Less than one hour per day or Never?
- M2 Between 1 and 4 hours per day?
- M3 More than 4 hours per day?

Observation Method Example - Quick Exposure Check (QEC)

Observer's Assessment

Wrist/Hand

E **Is the task performed with**
(select worse case situation)

E1 An almost straight wrist?
E2 A deviated or bent wrist?

F **Are similar motion patterns repeated**

F1 10 times per minute or less?
F2 11 to 20 times per minute?
F3 More than 20 times per minute?

Neck

G **When performing the task, is the head/neck bent or twisted?**

G1 No
G2 Yes, occasionally
G3 Yes, continuously

Worker's Assessment

N **At work do you use vibrating tools for**

N1 Less than one hour per day or Never?
N2 Between 1 and 4 hours per day?
N3 More than 4 hours per day?

P **Do you have difficulty keeping up with this work?**

P1 Never
P2 Sometimes
*P3 Often

* *If Often, please give details in the box below*

Q **In general, how do you find this job**

Q1 Not at all stressful?
Q2 Mildly stressful?
*Q3 Moderately stressful?
*Q4 Very stressful?

* *If Moderately or Very, please give details in the box below*


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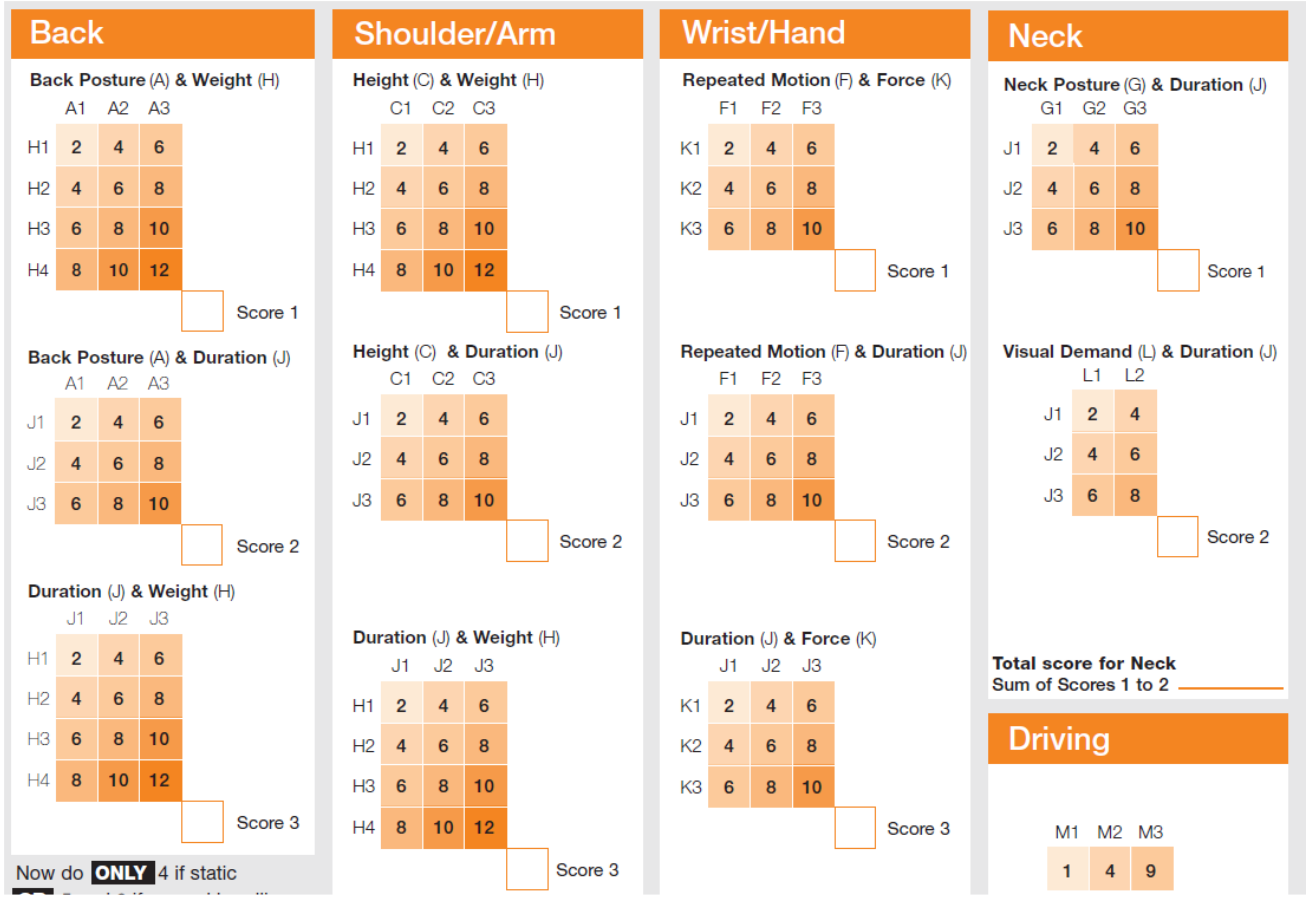
5. Bena ur

Observation Method Example - Quick Exposure Check (QEC)



Back

Back Posture (A) & Weight (H)

	A1	A2	A3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Back Posture (A) & Duration (J)

	A1	A2	A3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Weight (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Now do **ONLY** 4 if static

Shoulder/Arm

Height (C) & Weight (H)

	C1	C2	C3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Height (C) & Duration (J)

	C1	C2	C3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Weight (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Wrist/Hand

Repeated Motion (F) & Force (K)

	F1	F2	F3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 1

Repeated Motion (F) & Duration (J)

	F1	F2	F3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Force (K)

	J1	J2	J3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 3

Neck

Neck Posture (G) & Duration (J)

	G1	G2	G3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 1

Visual Demand (L) & Duration (J)

	L1	L2
J1	2	4
J2	4	6
J3	6	8

Score 2

Total score for Neck
Sum of Scores 1 to 2 _____

Driving

M1	M2	M3
1	4	9

Back

Back Posture (A) & Weight (H)

	A1	A2	A3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Back Posture (A) & Duration (J)

	A1	A2	A3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Weight (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Now do **ONLY** 4 if static
OR 5 and 6 if manual handling

Static Posture (E) & Duration (J)

	B1	B2
J1	2	4
J2	4	6
J3	6	8

Score 4

Frequency (E) & Weight (H)

	B3	B4	B5
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 5

Frequency (E) & Duration (J)

	B3	B4	B5
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 6

Total score for Back
Sum of scores 1 to 4 **OR**
Scores 1 to 3 plus 5 and 6

Shoulder/Arm

Height (C) & Weight (H)

	C1	C2	C3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Height (C) & Duration (J)

	C1	C2	C3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Weight (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Frequency (D) & Weight (H)

	D1	D2	D3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 4

Frequency (D) & Duration (J)

	D1	D2	D3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 5

Total score for Shoulder/Arm
Sum of Scores 1 to 5

Wrist/Hand

Repeated Motion (F) & Force (K)

	F1	F2	F3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 1

Repeated Motion (F) & Duration (J)

	F1	F2	F3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) & Force (K)

	J1	J2	J3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 3

Wrist Posture (E) & Force (K)

	E1	E2
K1	2	4
K2	4	6
K3	6	8

Score 4

Wrist Posture (E) & Duration (J)

	E1	E2
J1	2	4
J2	4	6
J3	6	8

Score 5

Total score for Wrist/Hand
Sum of Scores 1 to 5

Neck

Neck Posture (G) & Duration (J)

	G1	G2	G3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 1

Visual Demand (L) & Duration (J)

	L1	L2
J1	2	4
J2	4	6
J3	6	8

Score 2

Total score for Nock
Sum of Scores 1 to 2

Driving

M1	M2	M3
1	4	9

Total for Driving

Vibration

N1	N2	N3
1	4	9

Total for Vibration

Work pace

P1	P2	P3
1	4	9

Total for Work pace

Stress

Q1	Q2	Q3	Q4
1	4	9	16

Total for Stress

Observational methods

Applied Ergonomics 86 (2020) 103101

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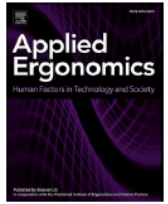
journal homepage: http://www.elsevier.com/locate/apergo



The RAMP package for MSD risk management in manual handling – A freely accessible tool, with website and training courses

Linda M. Rose [a,*], Jörgen Eklund [a,d], Lena Nord Nilsson [a,b], Linda Barman [c], Carl M. Lind [a,d]

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[b] Scania CV AB, Department of Safety and Health, Södertälje, Sweden
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ABSTRACT

In this paper the RAMP Package is presented with the objective to facilitate the application of the RAMP tool to systematically manage MSD risks. The package consists of the RAMP tool (Risk Assessment and Management tool for manual handling Proactively), the RAMP website, and free, globally available online, training courses (MOOCs). An Action module used for managing identified MSD risks is introduced. The tool, encompassing a wide range of risks, is applicable to the whole risk management process. Furthermore, RAMP is openly available for download, and free to use. The RAMP tool and training materials were developed using a participative iterative methodology including researchers and practitioners. RAMP was downloaded in 86 countries in the first 26 months since its' launch and over 2400 learners from high-, middle- and low-income countries have joined the MOOCs. The RAMP Package meets organisations' needs for an accessible, comprehensive risk assessment and management tool.

Observational methods

The RAMP tool

Applied Ergonomics 86 (2020) 103101

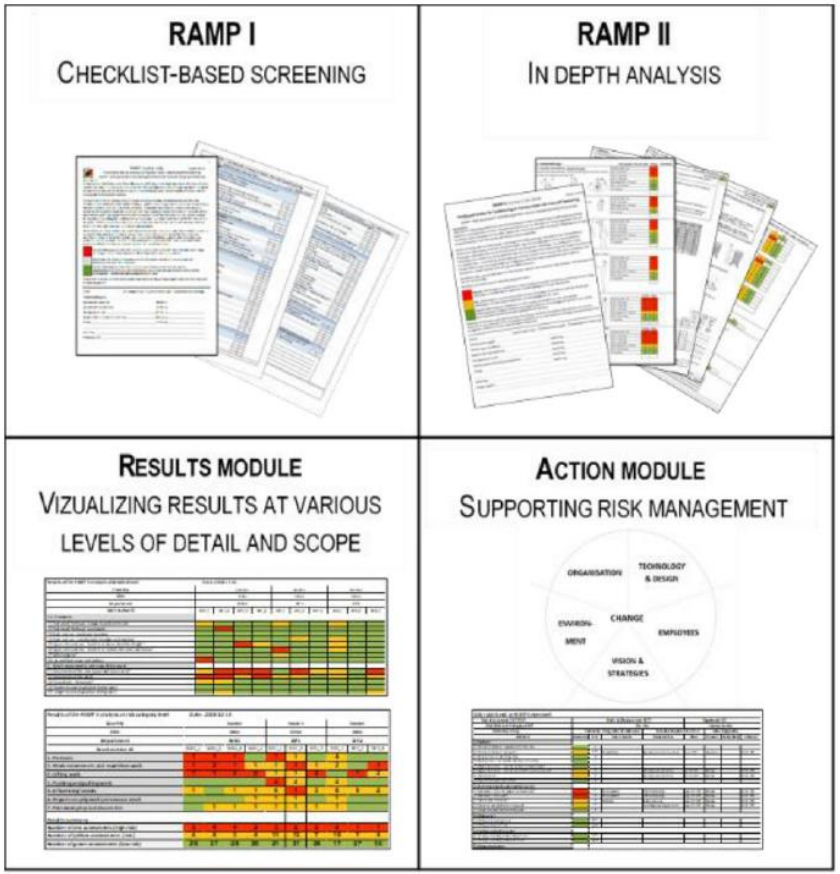


Fig. 1. Illustration of the RAMP tool structure with its four modules: RAMP I, RAMP II, the Results module and, the Action module.

Observation methods

Takala and co-workers, 2010, evaluated 30 observational methods, and found a need for further reliability testings.

Observation Reliability Project

12 experienced ergonomists were given:

10 video-recorded (2-5 minutes) work tasks

- supermarket work
- meat cutting and packing
- engine assembly
- cleaning
- post sorting
- hairdressing.

Data of:

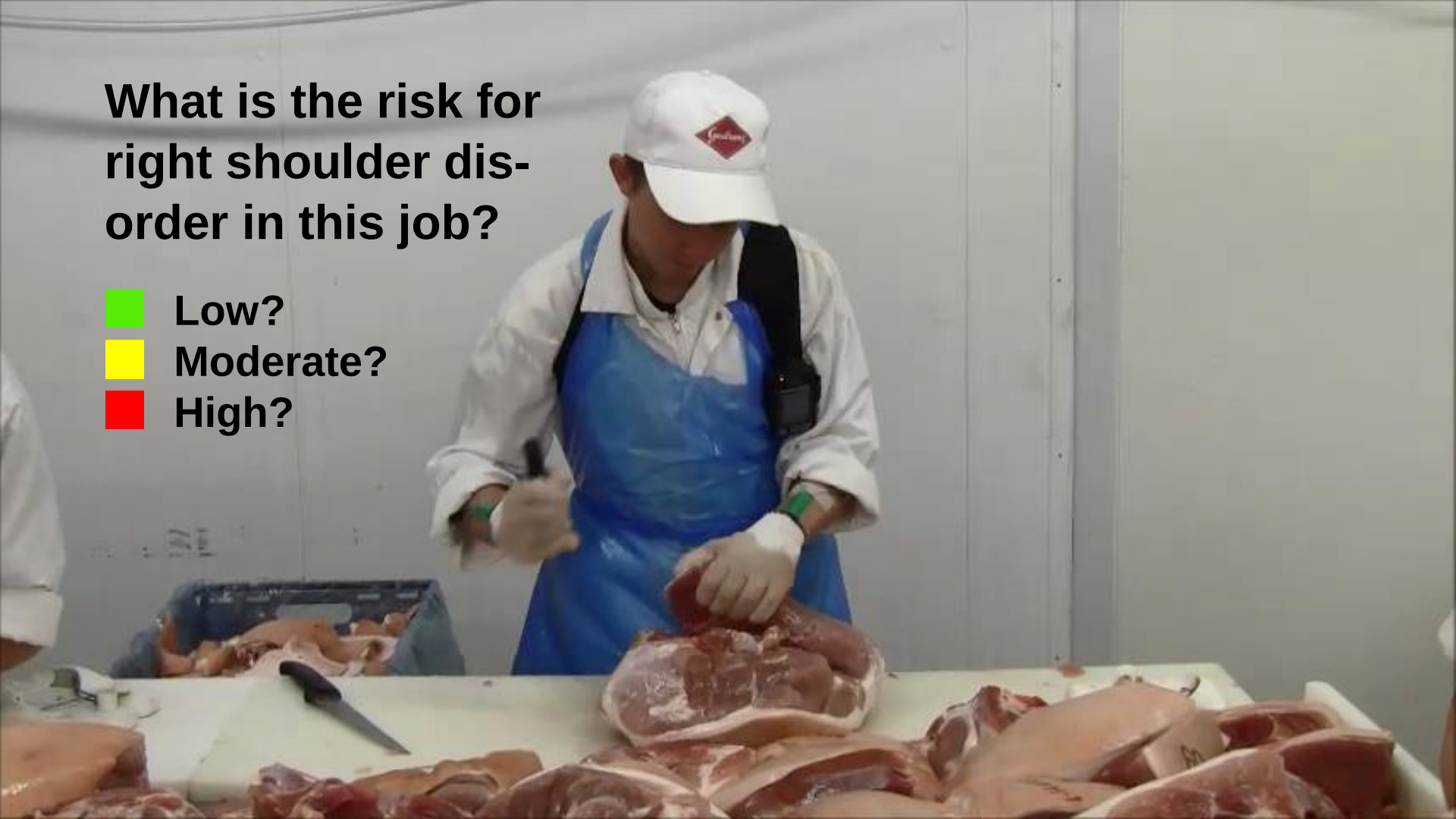
the work task length, pause- and rests-schedules, weights of handled goods, and the employees' ratings of discomfort, work demands and control, were given for each task.

The assessments were repeated after about 2 months.

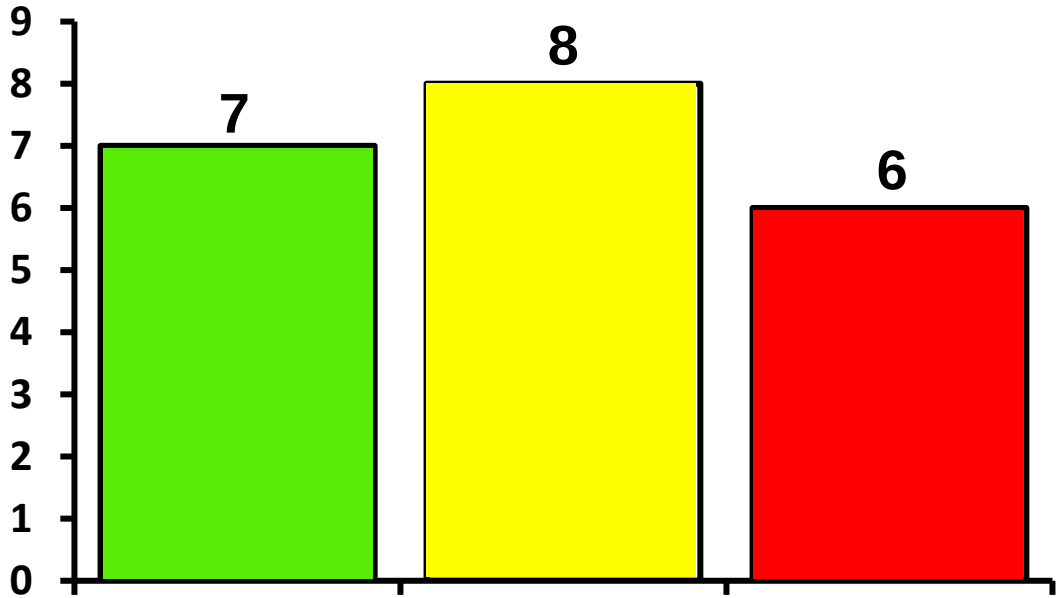
Observation Reliability Project

The ergonomists were trained in, and used, 6 observation methods.

0. They also did an own experience – no method
1. Occupational Repetitive Actions checklist (OCRA)
2. Quick Exposure Checklist (QEC)
3. Strain Index (SI)
4. Assessment of Repetitive Tasks (ART)
5. Hand Arm Risk-assessment Method (HARM)
6. Repetitive work model by the Swedish Work Environment Authority


What is the risk for right shoulder dis-order in this job?
Low?
Moderate?
High?

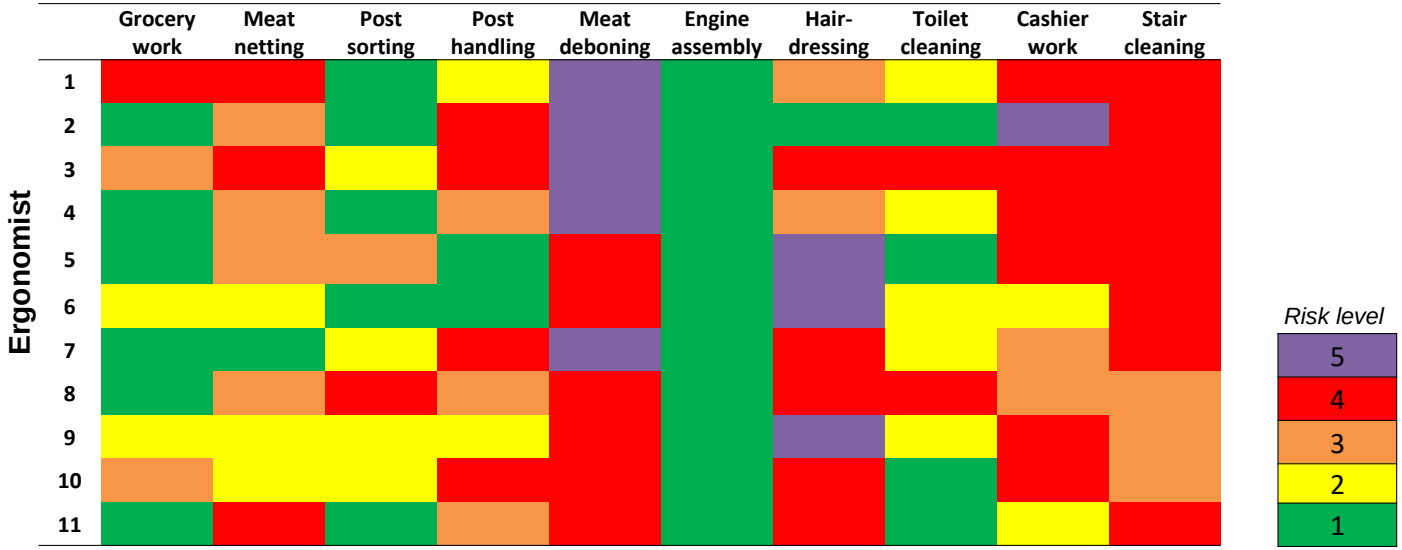
Number of ergonomist per category




Neck
Left shoulder
Left elbow
Left wrist
Right shoulder
Right elbow
Right wrist
Low back
Total risk
Unpack groceries to shelves
Put nets around roasts
Throw small boxes in containers
Put packs of letters into boxes
Debone meat
Engine assembly
Hair cutting
Toilet cleaning
Supermarket cashier work
Cleaning stairs
High risk
Moderate risk
Low risk
Red
Yellow
Green
20 Ratings

OCRA over-all risk level

Proportional agreement between ergonomists (39%)
Linearly weighted kappa = 0.41



Rhén IM, Forsman M. 2020. Inter- and intra-rater reliability of the OCRA checklist method in video-recorded manual work tasks. Appl Ergon. 84:103025.

Results

Reliability

Linearly Weighted Kappa

Method	Risk level for	Inter-rater
QEC	Total (with 4 levels)	0.55
	Total (with 3 levels)	0.41
HARM	Total	0.65
SI	Left Hand	0.39
	Right Hand	0.48
	The Highest Risk Hand	0.47
OCRA	Total	0.37
SWEA	Tot Risk Posture and Movements	0.21
	Sitting / Standing	1.00
	Neck	0.22
	Back	0.16
	Arm/Shoulder	0.21
	Leg	0.05
Own assessment	Neck	0.27
	Right Shoulder	0.18
	Left Shoulder	0.32
	Left Arm/elbow	0.12
	Right Arm/elbow	0.15
	Right Hand/wrist	0.16
	Left Hand/wrist	0.18
	Lower Back	0.26
	Total Risk	0.31

Landis & Koch (1977):

< 0.20	– poor
0.21 – 0.40	– fair
0.41 – 0.60	– moderate
0.61 – 0.80	– substantial
0.81 – 1.00	– almost perfect

HARM Reliability

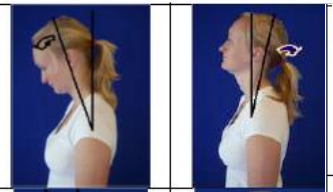
Postures

Neck-shoulder

Time in demanding postures:

<u>green yellow red</u>

0–10 10–50 >50%

The head is tilted further forward than in the first photograph OR tilted further back than in the second photograph	
The head is tilted further to the side than in the first photograph OR the head is turned, as in the second photograph	
The head is tilted forward **and turned at the same time**	
Shoulders raised (high)	
The head is tilted backward **and turned at the same time**	
Head/chin are pushed (far) forward	
The forearm arm is **unsupported** and the upper arm is further forward OR further sideways of the trunk than in the photographs, OR behind the trunk	

Inter-rater Reliability

Repetition, Movements and Postures

Method	κ_w	low	high
HARM	0.14 - 0.3	Hand/arm posture	Force duration/repetition
SI	0.04 - 0.40	Hand posture	Force repetition
OCRA	0.03 - 0.53	Elbow posture	Repetition
SWEA	0.05-0.22	Leg posture/movements	Neck posture/movements
Own assessment	0.12 - 0.27	Left elbow	Neck

Landis & Koch (1977):

< 0.20	– poor
0.21 – 0.40	– fair
0.41 – 0.60	– moderate
0.61 – 0.80	– substantial
0.81 – 1.00	– almost perfect

HARM Reliability Postures

Arm-wrist

Time in demanding postures:

green yellow red

0–10 10–50 >50%

Inter-rater

$\kappa_W = 0.14$

Intra-rater

$\kappa_W = 0.25$

Landis & Koch (1977):

< 0.20	– poor
0.21 – 0.40	– fair
0.41 – 0.60	– moderate
0.61 – 0.80	– substantial
0.81 – 1.00	– almost perfect

Elbow significantly bent or extended		
The forearm is rotated further (in the direction of the arrows) than in the photographs		
The hand is bent sideways (in the direction of the little finger and/or thumb) at the wrist so that the position of the wrist is between the positions shown in the photographs.		
The hand is bent at the wrist so that the position of the wrist is between the positions shown in the photographs		

Technical methods

Applied Ergonomics 55 (2016) 108–116

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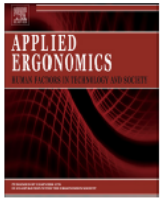

Validity of a small low-cost triaxial accelerometer with integrated logger for uncomplicated measurements of postures and movements of head, upper back and upper arms

Camilla Dahlqvist [a, b, *], Gert-Åke Hansson [a, b], Mikael Forsman [c]

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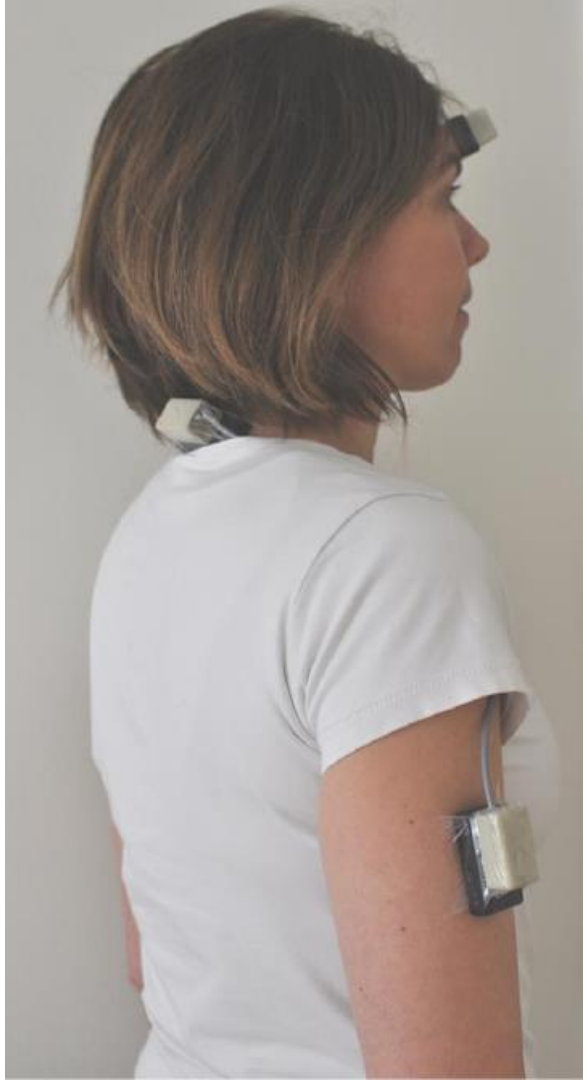
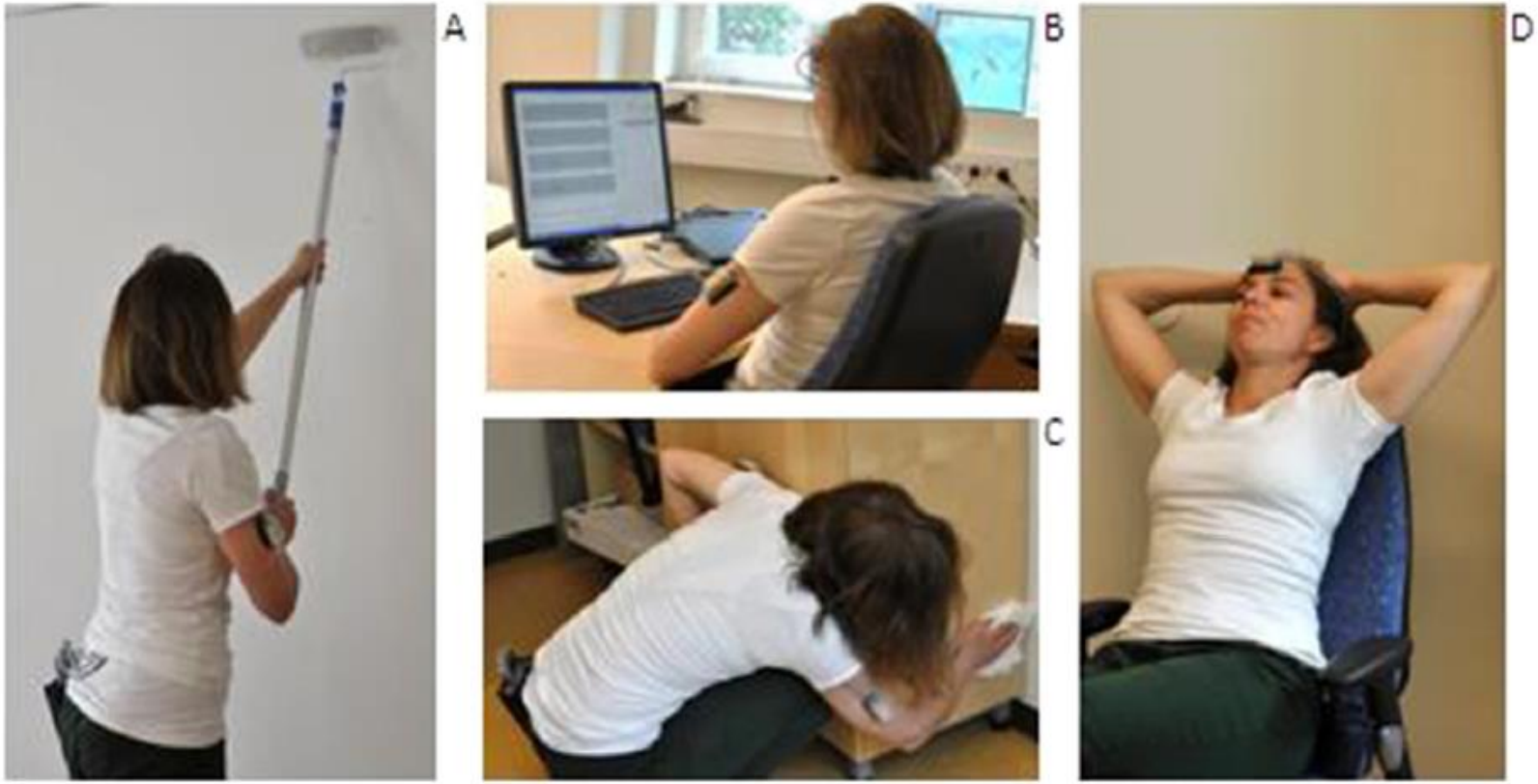
[b] Division of Occupational and Environmental Medicine, Lund University, Lund, Sweden
[c] Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden



Validation

Camilla Dahlqvist
Lund


A
B
C
D

Manual…

Tejpa på inklinometrarna med dubbelsidig toupé-tejp och eventuell gärna med extratejp över inklinometern på respektive kroppsdel (enligt figurer), med etiketten synlig.

Huvud: På pannan, horisontell med kontakten mot högra örat. Ett ”huvudband” kan användas (Björn Borg) för att dölja och hålla mätaren på plats.

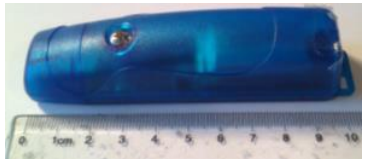
Rygg: Mellan skulderbladen,
nära ryggraden med kontakten uppåt.

Armar: Just nedanför armlyftarmuskelns (M. Deltoideus) fäste med kontakten uppåt. Här kan en avklippt strumpa eller en elastisk binda fungera för att hålla mätaren på plats.

Mätning och inledande referenspositioner

Huvud, rygg: Be personen att stå och titta rakt fram i ögenhöjd. Starta inklinometrarna, först huvud, sen rygg, med en magnet genom att mycket kort hålla (”doppa”) magneten nära inklinometerns kontakt (startad inklinometer blinkar till och fortsätter sedan blinka snabbt gult och mer glest rött). Håll referens-positionen i 5 sekunder efter att sista (rygg-) inklinometern startats, och avsluta med en framåtbugning.

There is also a simple Excel application



	A	B	C	D	E	F	G
1							
2	**Tider för refensposition (s)**						
3	**Start**	**Slut**					
4	4	6					
5							
6	**Tider för arbete 1 (tt:mm:ss)**						
7	**Start**	**Slut**					
8	00:00:05	00:03:00					
9							
10	**Tider för arbete 2 (tt:mm:ss)**						
11	**Start**	**Slut**					
12	00:02:35	00:02:45					
13							

Analysera Vinklar

Foto: Sofia Lindroth

Ny mätmetod ska minska skador

TEMA ARBETSMILJÖ. Att städa är ofta belastande för kroppen och många städare får förslitningsskador. Men det är svårt att bedöma riskerna eftersom det finns lite forskning som visar hur påfrestande jobbet är. Professor Mikael Forsman vill ändra på det med en ny mätmetod.

Mätningar av belastande arm-, rygg- och nackvinklar har gjorts på liknande sätt sedan 1980-talet, men aldrig tidigare har det varit så enkelt.
– Vi har tagit fram den här metoden framför allt till företagshälsovården, fram till nu har det bara varit forskare som haft tid, möjlighet och kanske även råd att mäta vinklar och belastning, säger Mikael Forsman, ergonom och professor på Centrum för arbets- och miljömedicin på Karolinska Institutet. Han har tilldelats över 2,2 miljoner kronor från Afa försäkring för att testa en ny mätstrategi av belastningsnivån för olika yrkesgrupper, i det här fallet

suntarbetsliv.se/forskning/fysisk-arbetsmiljo/sa-mater-du-armbelastning-med-mobilen/

suntarbetsliv | Områden | Verktyg | Så gör andra | Resursteam | Sök | Logga in

Liyun Yang, doktorand i ergonomi, har utvecklat en app som mäter belastning och armvinklar. Foto: Adam Fredholm

Fysisk arbetsmiljö

Så mäter du armbelastning med mobilen

Idag räknar vi promenadsteg och klockar löprundan med hjälp av våra smarta telefoner. Doktoranden Liyun Yang har utvecklat en app som gör att man kan mäta belastning och arbetsvinkel på sin arm med telefonen.

Verktyg

ErgoArmMeter

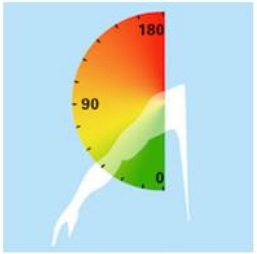
Forskning

Listen

ErgoArmMeter

Unit of Occupational medicine

ErgoArmMeter – A novel iOS application for measuring arm inclination

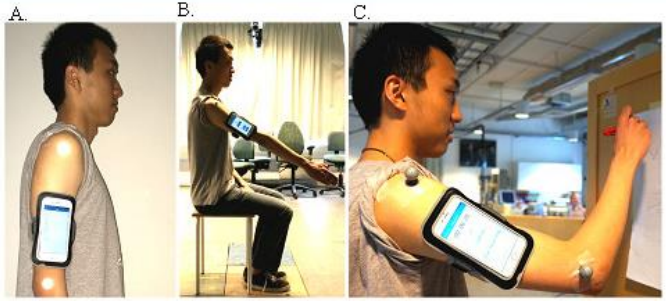


The ErgoArmMeter icon

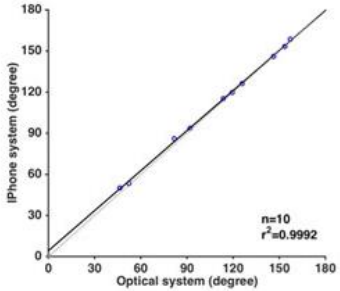
ErgoArmMeter is a professional inclinometer application for measuring arm elevation during work. It is developed by Liyun Yang (KTH Royal Institute of Technology) under the supervison of Mikael Forsman (Karolinska Institutet). This project is a collaboration between Institute of Environmental Medicine at Karolinska Institutet (KI) and School of Technology and Health at KTH Royal Institute of Technology (KTH).

It is shown by research that work with elevated arm may lead to shoulder/neck disorders. Ergonomists have been using inclinometers to measure arm elevation, which

ErgoArmMeter
Related articles & reports

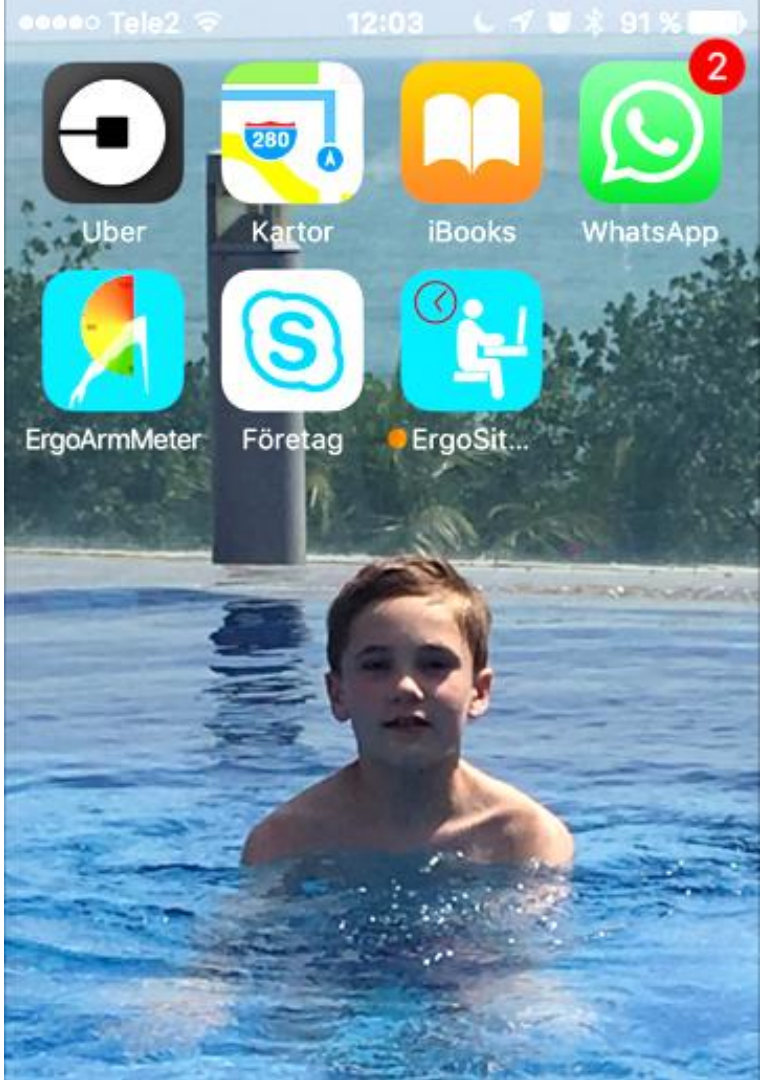


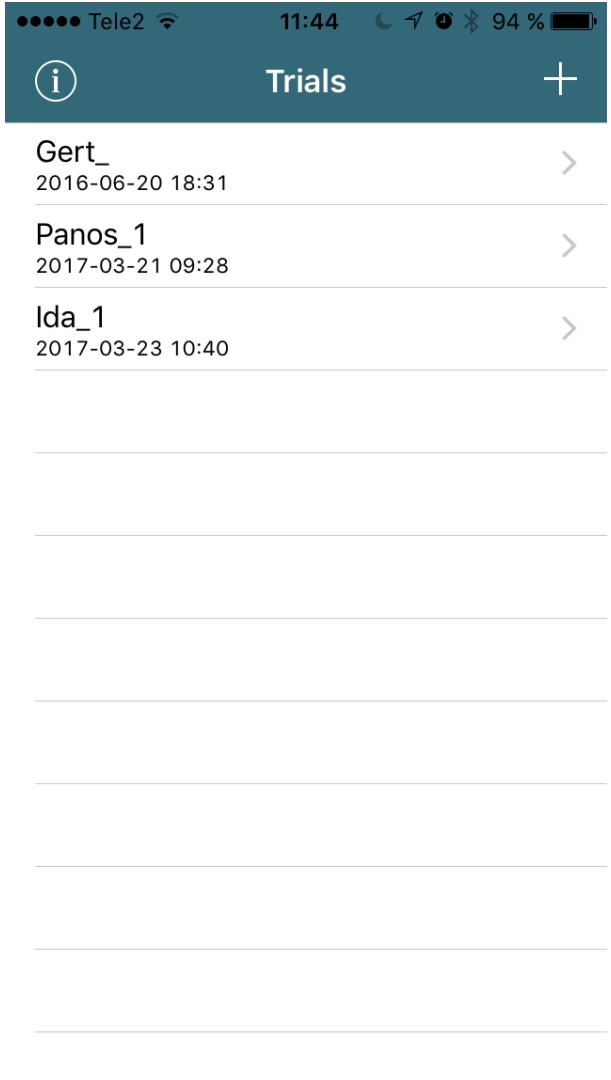
The validation experiment in the optical motion lab. A: Placement of two reflective markers and the iPhone with armband on right arm. B: Arm flexion posture. C: Painting on a straight board.

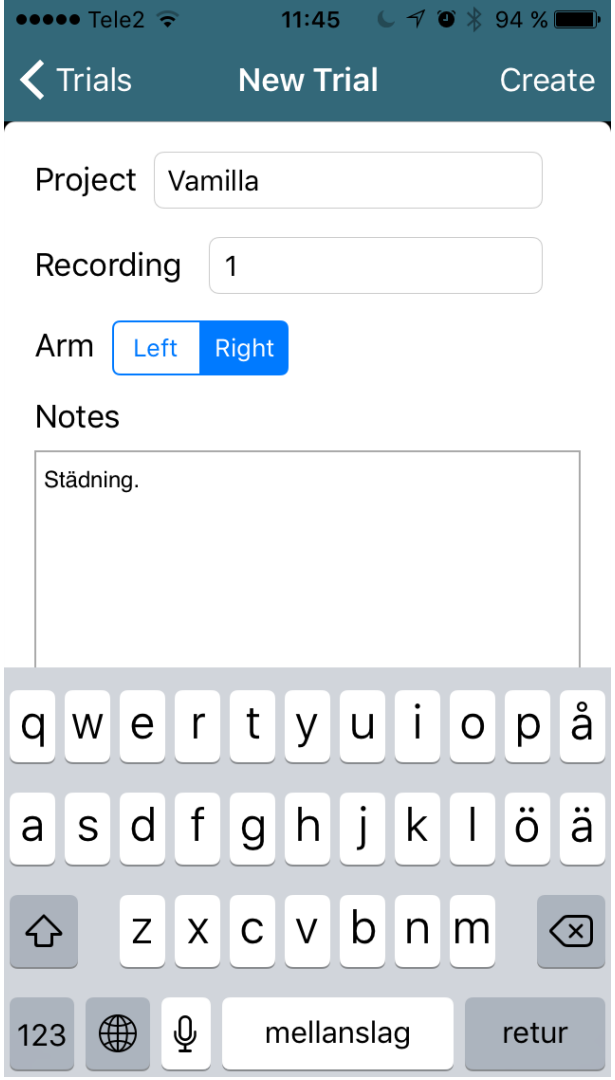


Upper arm inclination measurement during arm flexion. From the static experiment (B in the previous figure).

The validation experiments showed a high level of agreement between the two systems. In the static experiment (B, in the experiment-figure), the mean absolute difference between the optical system's angles and those of the app was 1.5°.


Tele2
12:03
91 %
Uber
Kartor
iBooks
WhatsApp
2
ErgoArmMeter
Företag
ErgoSit...


Tele2
11:44
94 %
Trials
Gert_
2016-06-20 18:31
Panos_1
2017-03-21 09:28
Ida_1
2017-03-23 10:40


Tele2
11:45
94 %
Trials
New Trial
Create
Project
Vamilla
Recording
1
Arm
Left
Right
Notes
Städning.
q w e r t y u i o p å
a s d f g h j k l ö ä
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123
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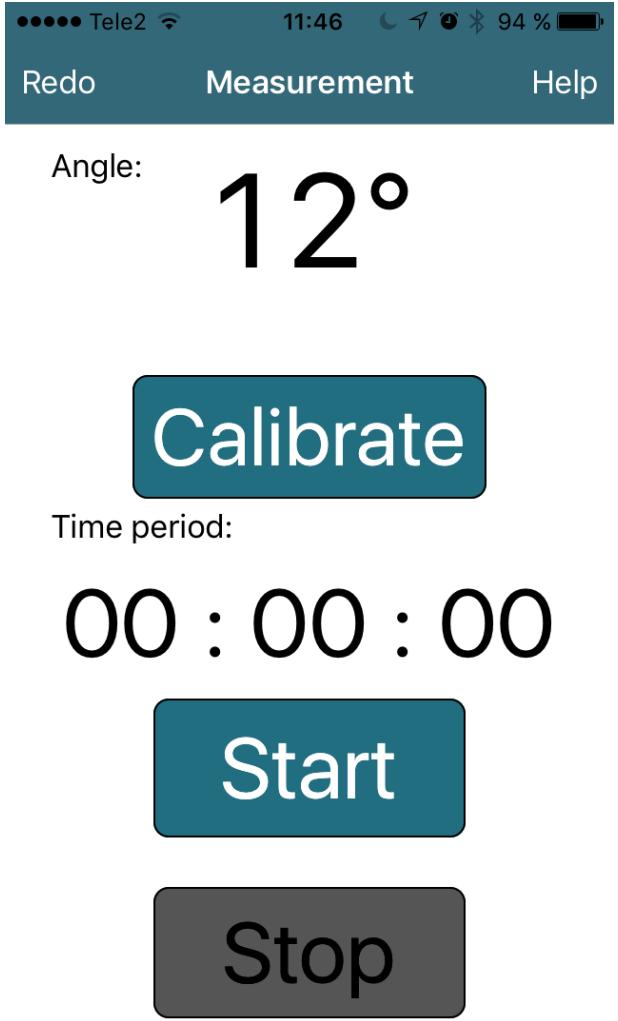
Tele2
11:46
94 %
Redo
Measurement
Help
Angle:
12°
Calibrate
Time period:
00 : 00 : 00
Start
Stop


Tele2
11:47
93 %
Redo
Measurement
Help
Angle:
1°
Calibration is done.
Calibrate
Time period:
00 : 00 : 00
Start
Stop

Liyun Yang, doktorand i ergonomi, har utvecklat en app som mäter belastning och armvinklar.

FOTO: ADAM FREDHOLM

Applied Ergonomics 55 (2016) 70–84

Contents lists available at ScienceDirect

Applied Ergonomics

journal homepage: www.elsevier.com/locate/apergo

Exposure–response relationships for work-related neck and shoulder musculoskeletal disorders – Analyses of pooled uniform data sets

Catarina Nordander*, Gert-Åke Hansson, Kerstina Ohlsson, Inger Arvidsson, Istvan Balogh, Ulf Strömberg, Ralf Rittner, Staffan Skerfving

Division of Occupational and Environmental Medicine, Department of Laboratory Medicine, Lund University, SE-221 85 Lund, Sweden

Applied Ergonomics 44 (2013) 241–253

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Catarina Nordander*, Kerstina Ohlsson, Ingrid Åkesson, Inger Arvidsson, Istvan Balogh, Gert-Åke Hansson, Ulf Strömberg, Ralf Rittner, Staffan Skerfving

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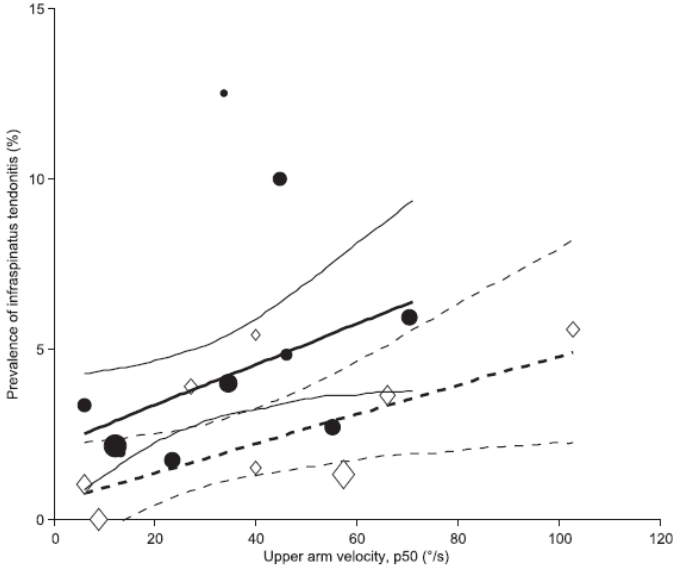


Fig. 1. Association between the prevalence of right-side infraspinatus tendonitis and right upper arm velocity (50th percentile) in 10 groups of female workers (N = 1044; filled circles) and 8 groups of male workers (N = 753; open diamonds). The size of the symbol corresponds to the number of workers in each of the occupational groups. Regression lines (solid for females, dotted for males) are shown together with 95% confidence intervals (by bootstrapping). The fits to the data gave the equations y = 2.14 + 0.06x for women and y = 0.45 + 0.04x for men, i.e. slopes of 0.06 and 0.04, respectively.

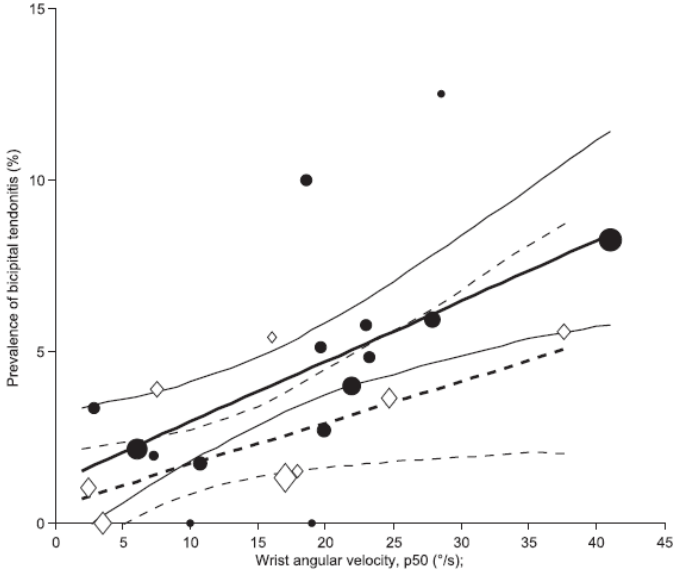


Fig. 3. Association between the prevalence of right-side bicipital tendonitis and angular velocity of the right wrist [50th percentile (p50)] in 15 groups of female workers (N = 1483; filled circles) and 8 groups of male workers (N = 753; open diamonds). The size of the symbol corresponds to the number of workers in each occupational group. The fits to the data gave the equations y = 1.2 + 0.2x for women and y = 0.3 + 0.1x for men, i.e. slopes of 0.2 and 0.1, respectively.

Balogh *et al. BMC Musculoskeletal Disorders* (2019) 20:139
https://doi.org/10.1186/s12891-019-2491-6

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Work-related neck and upper limb disorders – quantitative exposure–response relationships adjusted for personal characteristics and psychosocial conditions

Istvan Balogh, Inger Arvidsson, Jonas Björk, Gert-Åke Hansson, Kerstina Ohlsson, Staffan Skerfving and Catarina Nordander*

Results: Associations were found between head velocity, trapezius activity, upper arm velocity, forearm extensor activity and wrist posture and velocity, and most neck/shoulder and elbow/hand complaints and diagnoses. Adjustment for age, other individual characteristics and psychosocial work conditions had only a limited effect on these associations. For example, the attributable fraction for tension neck syndrome among female workers with the highest quintile of trapezius activity was 58%, for carpal tunnel syndrome versus wrist velocity it was 92% in men in the highest exposure quintile.

Conclusions: Based on the findings, we propose threshold limit values for upper arm and wrist velocity.

Arbets- och miljömedicin Syd

Rapport nr 18/2017

Åtgärdsnivåer mot belastningsskada

Inger Arvidsson
Ergonom, Dr Med Vet

Camilla Dahlqvist
Biomedicinsk analytiker, doktorand

Henrik Enquist
Civilingenjör, Tekn Dr

Catarina Nordander
Överläkare, docent

Arbets- och miljömedicin Syd

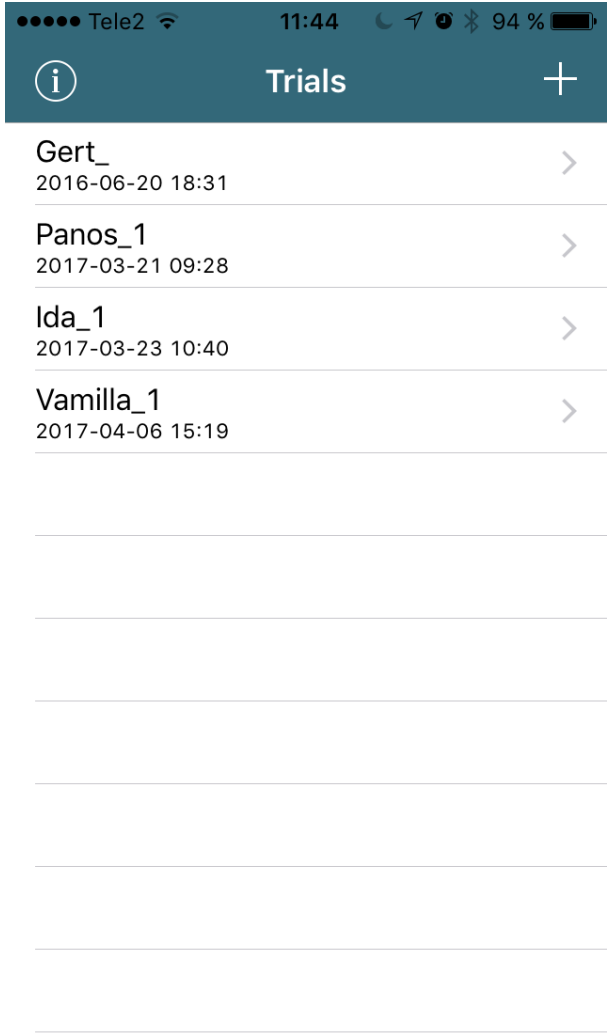
2017-11-13

Action levels for prevention of work related musculoskeletal disorders

	Action level
Median load [a]	
Movement velocity	
Upper arm	60 °/s
Wrist [b]	20 °/s
Posture	
Head flexion (forward)	25°
Elevated arm [cd]	30°
Muscle activity	
Forearm extensor muscles	10 % of max
Peak load [a]	
Postures	
Head extension (backward)	10°
Head flexion	50°
Elevated arm [c]	60°
Muscle activity	
Forearm extensor muscle	30 % of max
Time for recovery [e]	
Shoulder muscle (m Trapezius)	5 % of time
Forearm extensor muscles	5 % of time

[a] High risk of disorders at higher exposure
[b] If the work also is force-demanding, the action level is 15 °/second
[c] Elevation in relation to the vertical line
[d] Applies if the arms are not supported (e.g. at a table surface)
[e] High risk of disorders at lower time for recovery.

Lunds Universitet · Landstinget Blekinge · Region Kronoberg · Bästa livsplatsen Region Halland · Region Skåne


Tele2
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Trials
Gert_
2016-06-20 18:31
Panos_1
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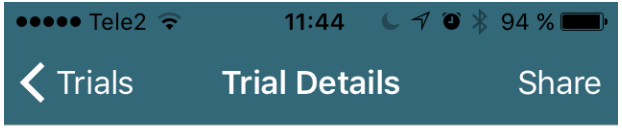
Ida_1
2017-03-23 10:40
Vamilla_1
2017-04-06 15:19



Date & Time: 2017/04/06 15:19

Project: Vamilla Recording: 1

Arm: Right arm

Trial Duration: 00h 02m 22s

Elevation angle percentile (%tile):

50th: 65.6°	[30°]
90th: 111.3°	[60°]

Elevation angle time percent:

> 30°: 77.9%	[50%]
> 60°: 53.7%	[10%]
> 90°: 28.3%	[-]

Generalized angular velocity %tile:

50th: 39.6°/s	[60 °/s]
90th: 162.4°/s	[-]

The red values in brackets are recommended limits for an 8-h work day, which are based on a report from Hansson et al., 2016 (in Swedish). The recommendations apply for unsupported arms.

KTH

News & Events

News

News in focus

Calendar

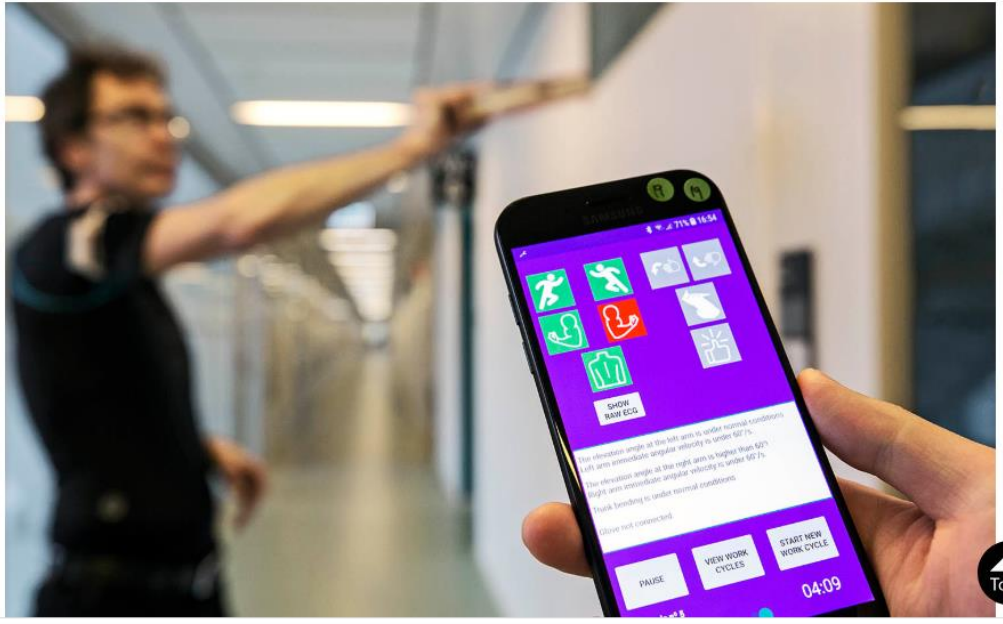
Academic ceremonies

Press and media

Procurement

THE Innovation & Impact Summit 2020

The smart top that tracks your body posture



Topp

Hand intensive work

Hand intensive work

Experiment in uMove lab

12 subjects

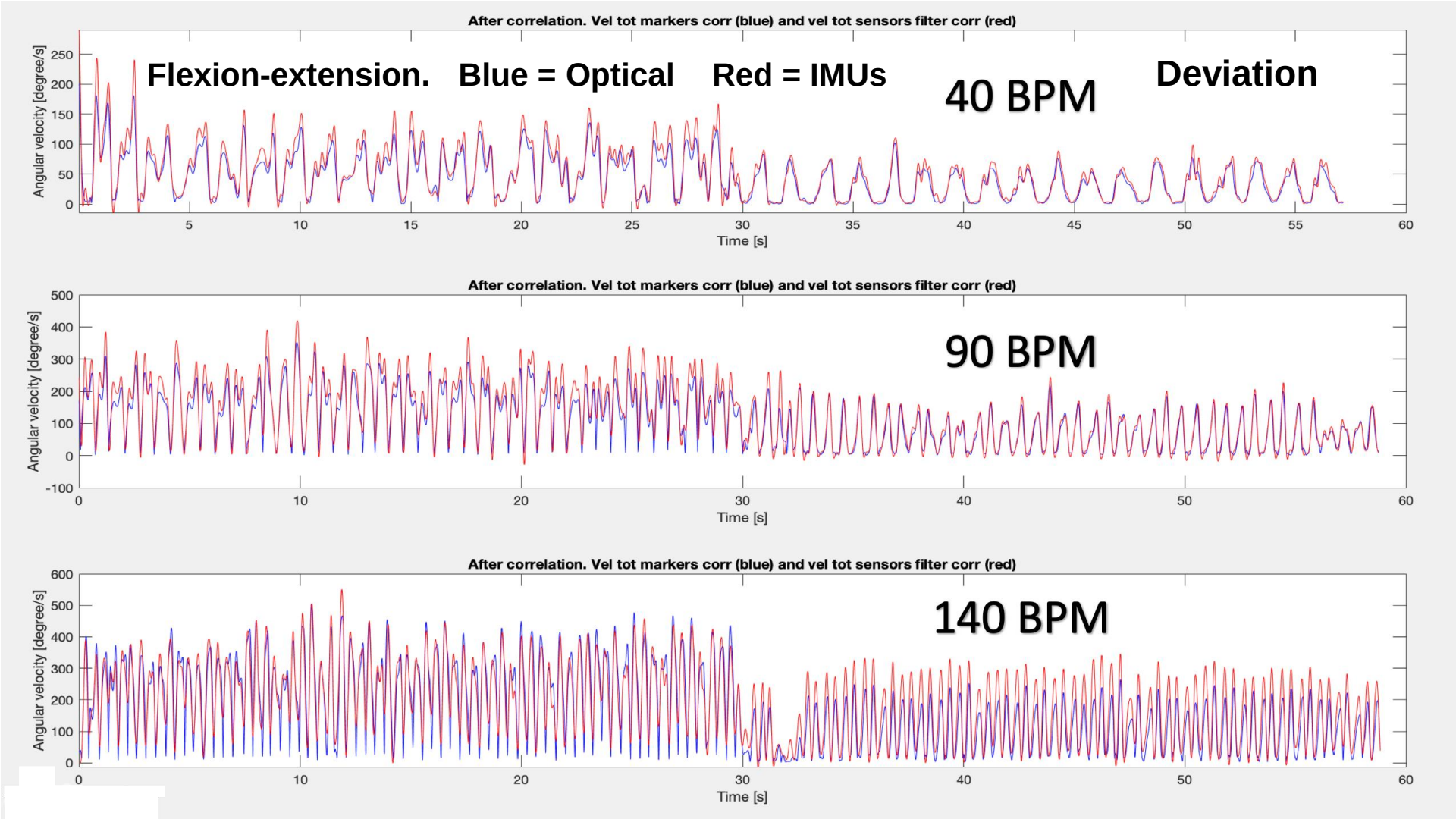
Jenny Wingqvist

Josephine Lantz

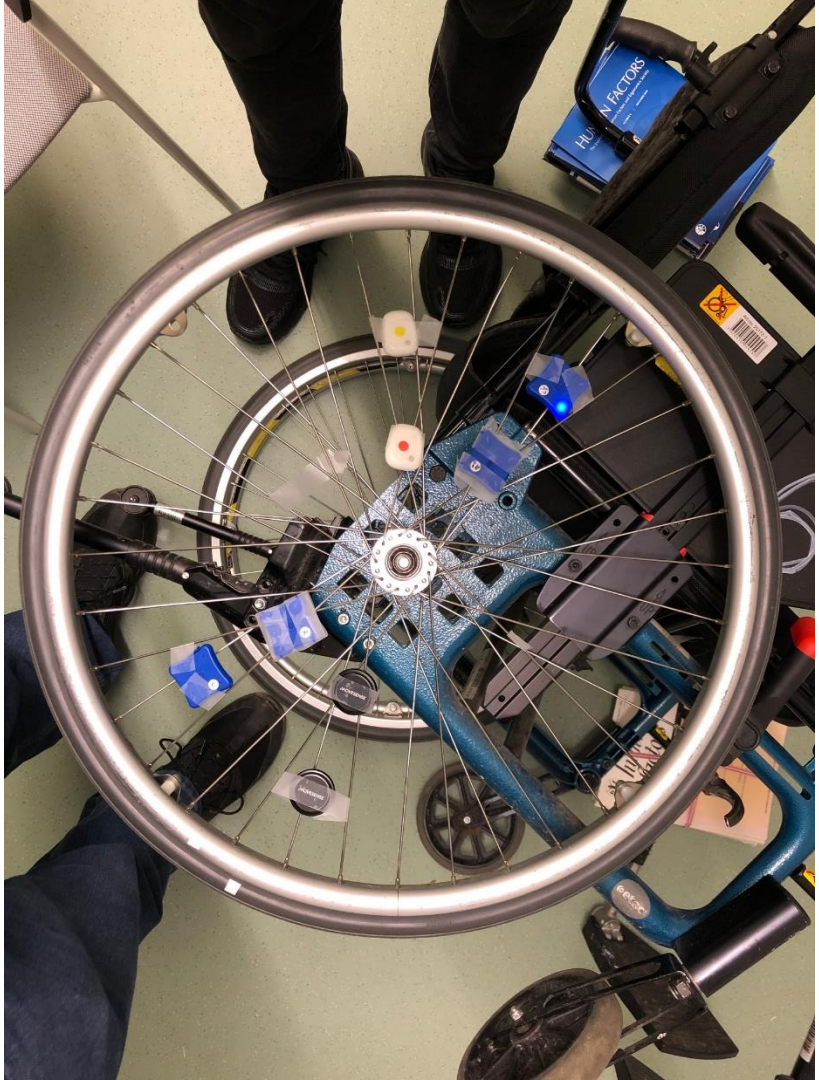
Thesis Work

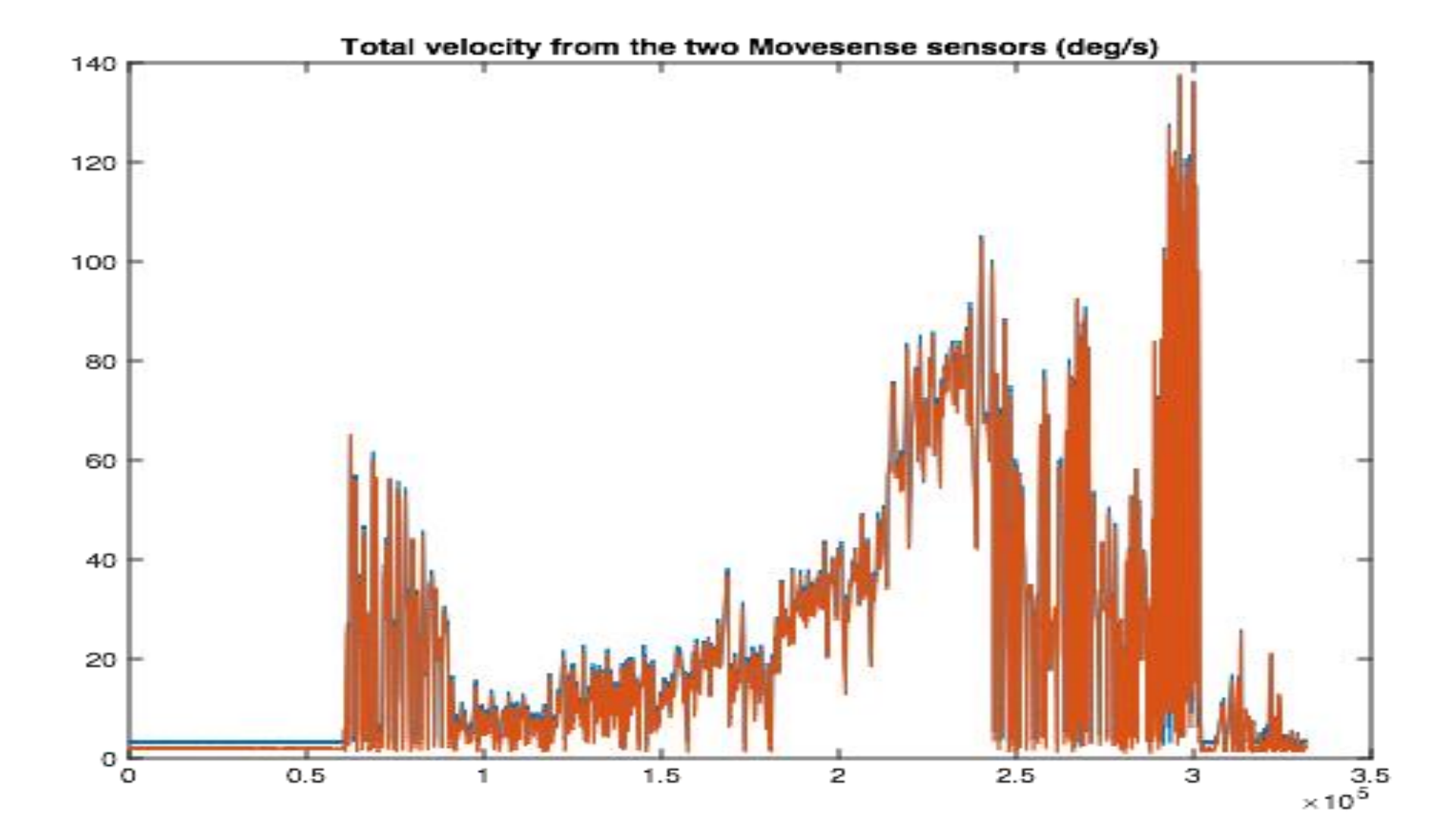
uMove - lab

Hairblowing


After correlation. Vel tot markers corr (blue) and vel tot sensors filter corr (red)
Flexion-extension. Blue = Optical Red = IMUs
40 BPM
Deviation
Angular velocity [degree/s]
Time [s]
After correlation. Vel tot markers corr (blue) and vel tot sensors filter corr (red)
90 BPM
Angular velocity [degree/s]
Time [s]
After correlation. Vel tot markers corr (blue) and vel tot sensors filter corr (red)
140 BPM
Angular velocity [degree/s]
Time [s]

Felipe Chinarro
Thesis work




Total velocity from the two Movesense sensors (deg/s)
140
120
100
80
60
40
20
0
0
0.5
1
1.5
2
2.5
3
3.5
×10^5

March 18th, 2020

Four New Projects Join Movesense Academic Program

POSTED IN Academic Program Movesense based projects


KTH
VETENSKAP
OCH KONST
MOVESENSE
MOVESENSE
20:29
Settings
Cancel
Measurement
Back
Angular velocity:
22°/s
Connect
Time:
00 : 00 : 00
Start
Lunch start
Stop

Myndigheten för arbetsmiljökunskap

ASSESSING ARM ELEVATION AT WORK WITH TECHNICAL SYSTEMS

PEROSH Joint Research Project

Recommendations for procedures to measure occupational physical activity and workload

Conclusion

- Use systematic methods.
- There are several observational methods for repetitive work
- With practical inexpensive inclinometers and applications in for IPhones you can obtain e.g. arm inclination – of research quality.
- We need more research on criteria for acceptable ranges (of different parameters).
- It is difficult to attract work health practitioners to start measure as a compliment to observations, the methods need to be uncomplicated, time efficient, and show useful results.

Thank you!