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RAMP - A tool for systematic MSD risk management in manual handling jobs

Presentation at University of Saskatchewan, Canada, 2017-07-28

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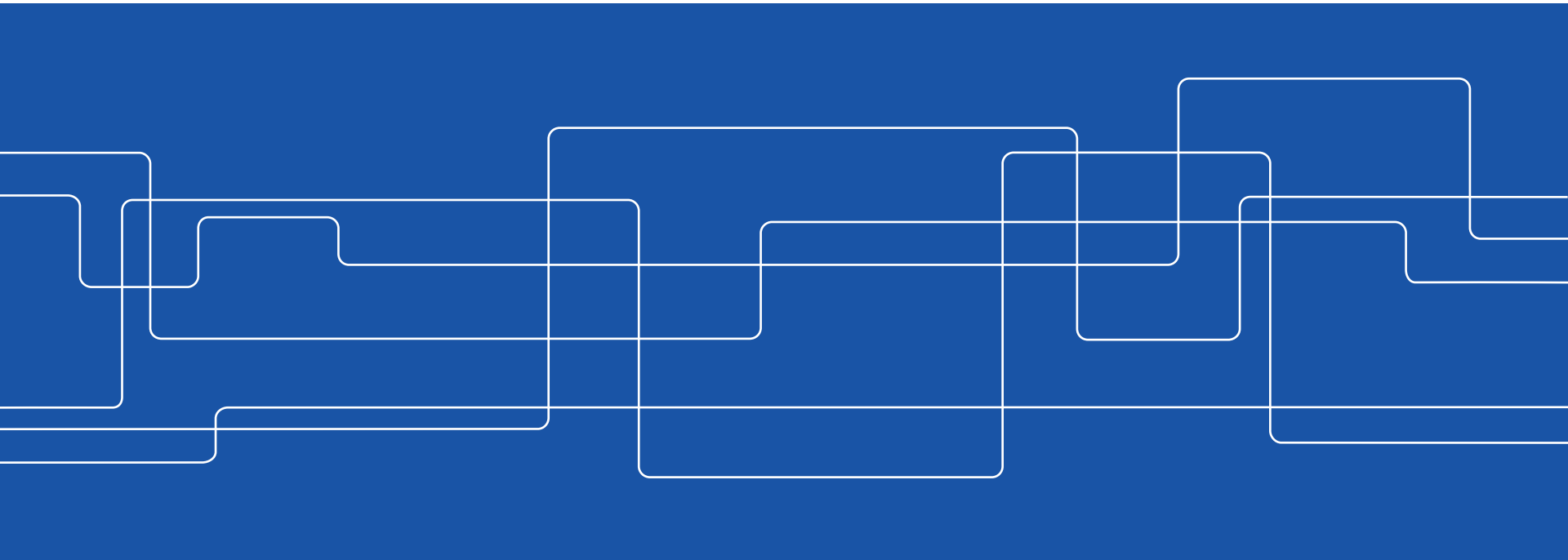
RAMP - *Risk Assessment and Management tool for manual handling Proactively*



Ergonomics

"*Ergonomics* (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order ***to optimize human well-being and overall system performance.***" [IEA, 2000]

Background

- MSDs a main problem, also in manual handling (MH) => negative human & system effects

- Industrial initiative – identified need for a systematic MSD risk management tool for MH jobs for global company use
- Developed in co-op with 4 companies with a participative & iterative methodology & financed by Afa Insurance, the companies & KTH

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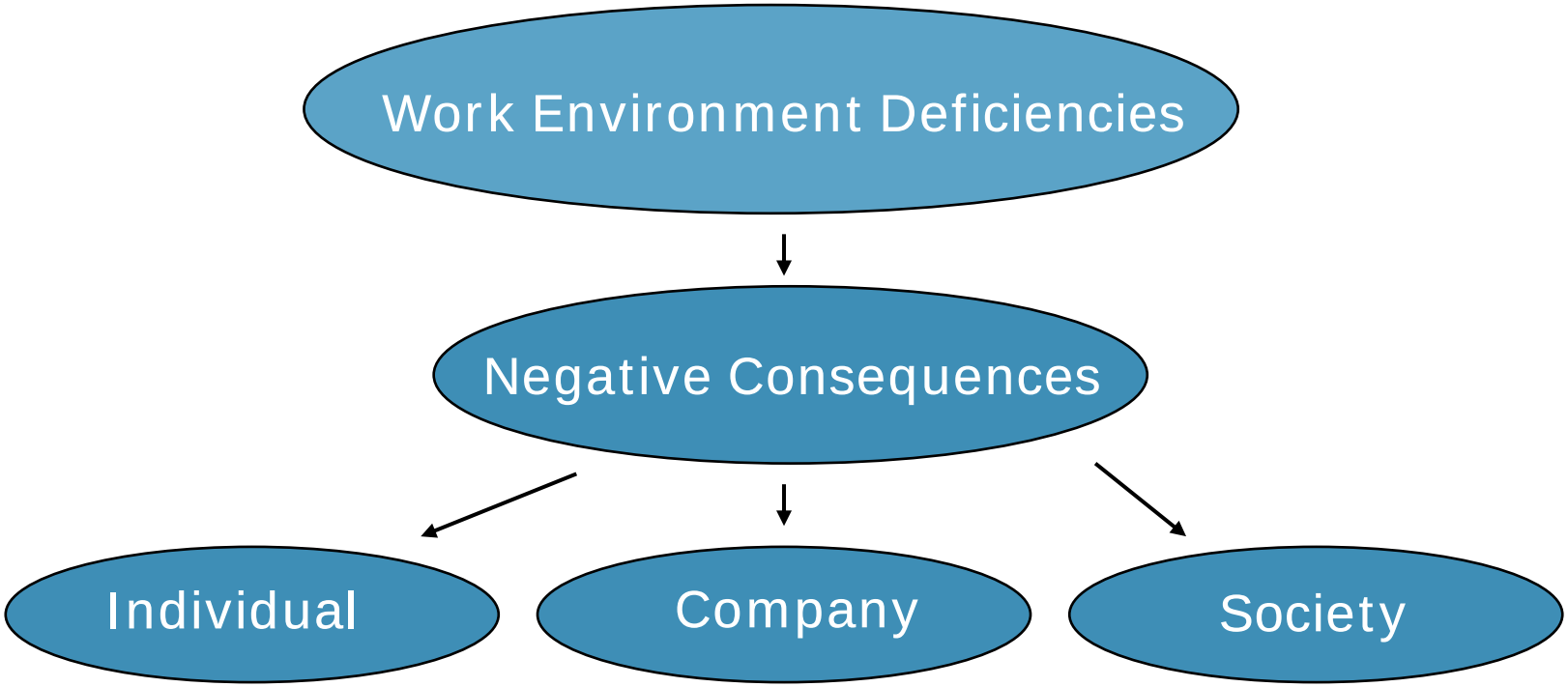
Effects of the Work Environment (WE)



[modified after Rose, 2001]

Challenges…

- Increased occurrence of work-related health problems in the EU, where MDSs play a mayor part. [Eurostat, 2010]
- 50 % of all born today may achieve the age of 92. [SCB, 2013]
- Many abilities decline with age. [Ilmarinen, 1992; Grandjean, 1988]
- In several professions many employees cannot work until retirement age, due to MSDs, e. g. in the construction industry. [Byggnads, 2013]

Need to stay healthy, work longer & have sustainable jobs!

In addition, the EU Directive on manual handling:

Employers shall take measures to avoid the need of manual handling. Where that is not possible, the employer shall assess the health and safety conditions of the work.

Is there <u>really</u> a need for another MSD tool?

Limitations in existing methods include that they:

- Often are subjective risk assessments (e.g. with own methods)
- Only assess certain body parts or certain types of work (e.g. RULA, NIOSH)
- No, limited or not available scientific base (e.g. WEST)
- Not freely available (e.g. Jack)
- Not high usability/user friendliness (e.g. OCRA)
- Assessments of exposure, not of risks (e.g. QEC)
- Only support part of the systematic risk management process (most methods)

Comprehensive physical ergonomics risk assessment tools?

	KIM 1	KIM 2	KIM 3	HARM	NIOSH lifting eq.	QEC	RULA	REBA	ART	OCRA	Strain Index	HAL	Washington state hazard zone checklist
Pushing & pulling work	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No
Heavy lifts	Yes	No	No	No	Yes	Yes	Partly	Yes	No	No	No	No	Yes
Repetitive work	No	No	Yes	Yes	No	Yes	Partly	No	Yes	Yes	Yes	Yes	Yes
Vibrations	No	No	No	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes
Neck, shoulders	No	No	Partly	Yes	No	Yes	Yes	Yes	Yes	Partly	No	No	Yes
Forearm, hand	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low back	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes
Legs	Partly	Yes	No	No	No	No	No	Yes	No	No	No	No	Yes
Knees/squatting	Yes	Yes	No	No	No	No	No	No	No	No	No	No	Yes
Dose (time) included	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes
Worker participation	No	No	No	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes
Working times/pauses	No	No	Partly	Partly	No	No	No	No	Yes	Yes	No	No	No
Visual conditions	No	No	Yes	No	No	Yes	No	No	Partly	No	No	No	No

[modified after Palm et al., (2014) and Lind (2015)]

Conclusion: There is a gap in ergonomic tools. So: Yes.

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Objective

- Develop a MSD risk management tool for manual handling jobs, which supports the whole systematic MSD risk management process
- It should be freely available & for company use
- Find strategies for dissemination – platform & organisation
- Develop support for free & available learning resources regarding the tool
- Contribute to decrease of work related MSDs

Methods

- Participative & iterative methodology
- Needs analysis & literature study
- RAMP tool based on: >250 research publications, standards, legislation, other risk assessment tools, expert group assessments, feed-back from over 80 practitioners, and the reference group
- Evaluations of prototypes and early versions
- RAMP MOOCs: multi-disciplinary collaboration-model for the design; including content experts, media producers & educationalists. Authentic cases. Continuous assessment & feedback

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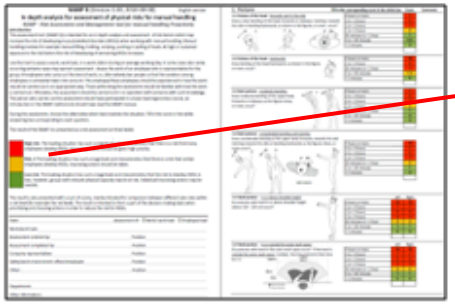
RAMP - four modules

RAMP I

Checklist assessment

RAMP II

In depth analysis



Results module

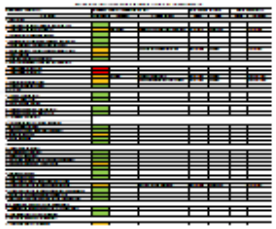
Display results at different level of detail & scope

RAMP II - In depth analysis for assessment of physical risks for manual handling

Department	Department A					Department B				
Work station	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2
1. Postures										
2. Work movements and repetitive work										
3. Lifting										
4. Pushing and pulling										
5. Influencing factors										
6. Reports on physically strenuous work										
7. Perceived physical discomfort										

Action module

Action model, suggestions & creating Action plans



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Seven risk categories

1. Postures
2. Work movements and repetitive work
3. Lifting work
4. Pushing and pulling work
5. Influencing factors
6. Reports on strenuous work
7. Perceived physical discomfort

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An brief example of RAMP I & RAMP II assessments

RAMP I analysis

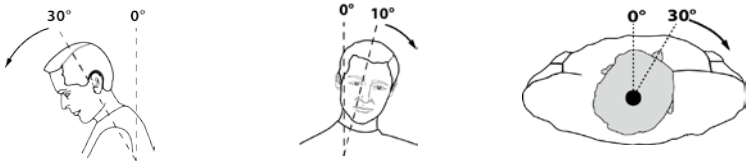
Mark the "Yes" or "No" boxes for the statements corresponding to the questions.	Yes	No	Comment:
1. Postures			
1.2 Does work occur in any of the following unfavourable postures about 1 hour per work day or more?			
head clearly twisted or bent - forwards or towards a side	x		

Results

Assessment

RAMP II analysis

1. Postures	**Fill in the corresponding score in the white box**	**Score:**	**Comment:**
1.1 Posture of the head - forwards and to the side Does a clear bending of the head forwards or to the side, or twisting to the side occur, as shown in the figures, or more?	4 hours or more	7	
	3 to < 4 hours	5	
	2 to < 3 hours	3	
	1 to < 2 hours	2	
	30 minutes to < 1 hour	1	
	5 to < 30 minutes	0,5	
	< 5 minutes	0	
		2	



Results

Assessment	Score
	2

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The Results module: Results at different level of scope and detail 1(3)

At detailed level

Results of the RAMP II analysis at detailed level	Date: 2017-03-27									
Country	Sweden									
Site	Sthlm					Sthlm			Sthlm	
Department	A					B			C	
Work station ID	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2
1.1. Postures										
1.1 Posture of the head - forwards and to the side										
1.2 Posture of the head - backwards										
1.3 Back posture - moderate bending										
1.4 Back posture - considerable bending and twisting										
1.5 Upper arm posture - hand in or above shoulder height*										
1.6 Upper arm posture - hand in or outside the outer work area*										
1.7 Wrist posture*										
1.8 Leg and foot space and surface										

- Visualises *where* Risk & Priority Levels are increased
- Visualises *what* causes the increased risks
- Can also be used for planning of work…

Results at different level of scope and detail 2(3)

At risk category level – less detail, better overview

Results of the RAMP II analysis at risk category level	Date: 2017-03-27									
Country	Sweden									
Site	Stockholm									
Department	A					B			C	
Work station ID	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2
1. Postures	1		1	1	3	2	2		1	
2. Work movements and repetitive work	1	1	2	1	1	1	2	1	2	
3. Lifting work	1	2	2	2	2	1	1		1	1
4. Pushing and pulling work						2	2	2		
5. Influencing factors	1	2	1	1	3	1	6	6	6	
6. Reports on physically strenuous work				1		1	1	1		
7. Perceived physical discomfort			1	1	1	1	1	1		
Results summary:										
Number of red assessments (high risk)	3	1	5	4	6	2	4	0	2	0
Number of yellow assessments (risk)	4	6	4	4	5	12	11	11	12	1
Number of green assessments (low risk)	28	28	26	27	24	21	20	24	21	34

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Results at different level of scope and detail 3(3)level

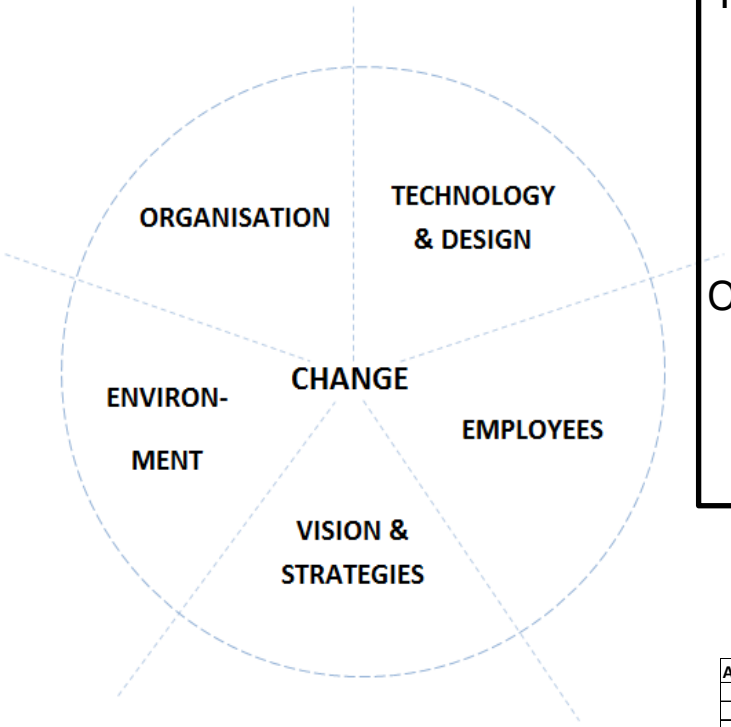
At overview level – tailored after company need

Results of the RAMP II analysis at overview leve	Date: 2017-06-13									
Country	Sweden					Canada				
Site	Stockholm			Gothenburg		Toronto			Montréal	
Department	S:A	S:B	S:C	G:A	G:B	T:A	T:B	T:C	M:A	M:B
Results summary:										
Number of red assessments (high risk)	6	3	10	30	10	10	20	8	15	12
Number of yellow assessments (risk)	16	10	20	60	15	18	35	14	30	20
Number of green assessments (low risk)	148	191	242	182	145	176	149	148	227	138

RAMP´s Action Module: three parts

1. Action Model

Support for finding suggestions



2. Action Suggestions

Automatically generated suggestions

T&D ORG	Investigate the visual conditions and secure that the lighting is appropriate for the work that is carried out (e.g. illuminance, glare, and contrast) and that the work area is arranged in an appropriate way to the light. See visual ergonomics guidelines. Maybe the employees visions need to be checked and visual aids obtained. Consider work organisational changes, e.g. job enrichment, job enlargement, job rotation. Review the work content regarding the amount/magnitude and frequency of the exposure.

3. Action Plan

Template for forming Action plans

Action plan

Date of assessment: 2016-04-20	Work task/ Employee load: Work station 3			Department: A2			
Work/Work task: Packaging at WS3	Site: Stockholm			Country: Sweden			
Orderd by: Jens Andersson	Formed by: Juilia Riviera		Date of action plan: 2016-04-29	Note: Urgent to solve!			
	Assessment	Score	Comments	Planned actions	When	By whom	Ready (date)	Follow-up
1. Arbetsställningar								
1.1 Posture of the head - forwards and to the side		2		Redseign work surface	May 2016	OSH/CP	2016-05-27	2016-06-03
1.2 Posture of the head - backwards		1,5		Lower shelves	May 2016	OSH/CP	2016-05-27	2016-06-03
1.3 Back posture - moderate bending		1						
1.4 Back posture - considerable bending and twisting		1						
1.5 Upper arm posture - hand in or above shoulder height*		7		Lower shelves, redesign worksp.	May 2016	OSH/CP	2016-05-27	2016-06-03
1.6 Upper arm posture - hand in or outside the outer work area*		2		Redseign work space	May 2016	OSH/CP	2016-05-27	2016-06-03
1.7 Wrist posture*		1						
1.8 Leg and foot space and surface		2		Redesign work space	May 2016	OSH/CP	2016-05-27	2016-06-03
2. Work movements and repetitive work								
2.1 Movements of the arm (upper and lower arm)*		0						
2.2 Movements of the wrist*		1		Rotate btwn jobs, redesign task	Sept 2016	Consultant	2016-11-25	2017-02-25
2.3 Type of grip - frequency*		1						
2.4 Shorter recovery/variation during work		0						

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Action plan

Action plan based on RAMP II assessment

Date of assessment: 2017-05-03	Work task/Employee load: WST 1				Department: KG			
Work/Work task: Packaging at WST	Site: Sala				Country: Sweden			
Ordered by: S Borg	Formed by: S Borg, L Kerr & J Andersson			Date of action plan: 2017-05-12		Note: High priority		
Risk factor	**Assessment**	**Score**	**User comments**	**Planned actions**	**When**	**By whom**	**Ready (date)**	**Follow-up**
1. Postures								
1.1 Posture of the head - forwards and to the side		1						
1.2 Posture of the head - backwards		1,5	Poor lightning	Improve visual cond, Low shelf	June 2, 2017	J Andersson		Oct 31, 2017
1.3 Back posture - moderate bending		0						
1.4 Back posture - considerable bending and twisting		1						
1.5 Upper arm posture - hand in or above shoulder height*		1						
1.6 Upper arm posture - hand in or outside the outer work area*		2		Redesign work area & task	July 29, 2017	P Kempe		Oct 31, 2017
1.7 Wrist posture*		2		Redesign work area & task	July 29, 2017	P Kempe		Oct 31, 2017
1.8 Leg and foot space and surface		0						
2. Work movements and repetitive work								
2.1 Movements of the arm (upper and lower arm)*		5	Old equipment	Technical redesign	August 23, 2017	P Kempe		Oct 31, 2017
2.2 Movements of the wrist*		5	Old equipment	Technical redesign	August 23, 2017	P Kempe		Oct 31, 2017
2.3 Type of grip - frequency*		2	Pinch grip	Introduce fixture	August 23, 2017	P Kempe		Oct 31, 2017
2.4 Shorter recovery/variation during work		4		Job enlargement & grip fixture	August 23, 2017	P Kempe		Oct 31, 2017
2.5 Longer recovery/variation during work		0						
3. Lifting work								
3.1 Lifting work (average case)		2,7						
3.2 Lifting work (worst case)		2,9						
4. Pushing and pulling work								
4.1 Pushing and pulling work (average case)		2,5						
4.2 Pushing and pulling work (worst case)		2,75						
5. Influencing factors								
5.1 Influencing physical factors hand/arm								
a+b. Hand-arm vibrations		0						
c. Warm or cold objects are handled manually		0						
d. The hand is used as an impact tool often or a long time		2		Introduce technical aid	July 29, 2017	P Kempe		Oct 31, 2017
e. Holding hand tools weighing more than 2.3 kg for more than 30 minutes		0						
f. Holding precision tools weighing more than 0.4 kg for more than 30 minutes		0						
5.2 Other physical factors								

Users - those responsible for

- and carry out risk assessments
- production & are dependent on good work environments
- the work environment
- decision makers at the company

RAMP MOOCs (Massive Open Online Courses)

- 3 courses under development (available via edX), free to follow
- Enable studies at own pace & among groups e.g. at companies
- Exams & a professional certificate available
- Built around authentic MH situations to facilitate learning on how to use RAMP for risk assessments & risk management in industries
- Emphasis on different types of assessments & feed-back

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Comprehensive physical ergonomics risk assessment tools?

	KIM 1	KIM 2	KIM 3	HARM	NIOSH lifting eq.	QEC	RULA	REBA	ART	OCRA	Strain Index	HAL	Washing-ton state hazard zone checklist	RAMP I	RAMP II
Pushing & pulling work	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No	Yes	Yes
Heavy lifts	Yes	No	No	No	Yes	Yes	Partly	Yes	No	No	No	No	Yes	Yes	Yes
Repetitive work	No	No	Yes	Yes	No	Yes	Partly	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vibrations	No	No	No	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes
Neck, shoulders	No	No	Partly	Yes	No	Yes	Yes	Yes	Yes	Partly	No	No	Yes	Yes	Yes
Forearm, hand	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low back	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Legs	Partly	Yes	No	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes
Knees/squatting	Yes	Yes	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Dose (time) included	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Worker participation	No	No	No	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Working times/pauses	No	No	Partly	Partly	No	No	No	No	Yes	Yes	No	No	No	Partly	Yes
Visual conditions	No	No	Yes	No	No	Yes	No	No	Partly	No	No	No	No	Yes	Yes

[modified after Palm et al. (2014) and Lind (2015)]

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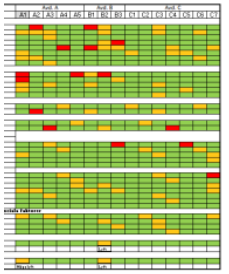
Experiences of RAMP in participating companies



- facilitates the systematic work to reduce risky working tasks: assess - prioritize - take actions - follow up

- provides a good overview of assessments and need for actions

- facilitates the dissemination of good solutions

- stimulates co-operation and increases knowledge (!)

→ *Supports the process of work environment improvement*

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Discussion

- Recently made available, evaluations on relevance to companies, implementation effects, etc will take some time
- On relevance: Scania has decided to & started to use RAMP as their global standard for managing MSD risks in manual handling jobs. Many have shown interest for the tool.
- Longitudinal studies planned, co-operation encouraged
- MOOCs to provide adequate training. Other training of interest
- How to spread freely accessible tools after the project is finished? And how secure updates in the future?
- RAMP used in smart textiles development projects which may enable observation tools in the future being developed into tools using measurements instead

Summary - RAMP:

- Freely available new digitalized MSD risk management tool for MH
- Broad range of risks assessed
- Research based, developed with users-to-be, usable & reliable
- Novel result visualisation to meet different communication needs
- Supports systematic risk management & *the process* of work environment improvement
- Excel based, available from stable platform & reliable organisation
- MOOCs will provide & secure relevant competence
- Can be used in forming & following relevant KPI´s over time

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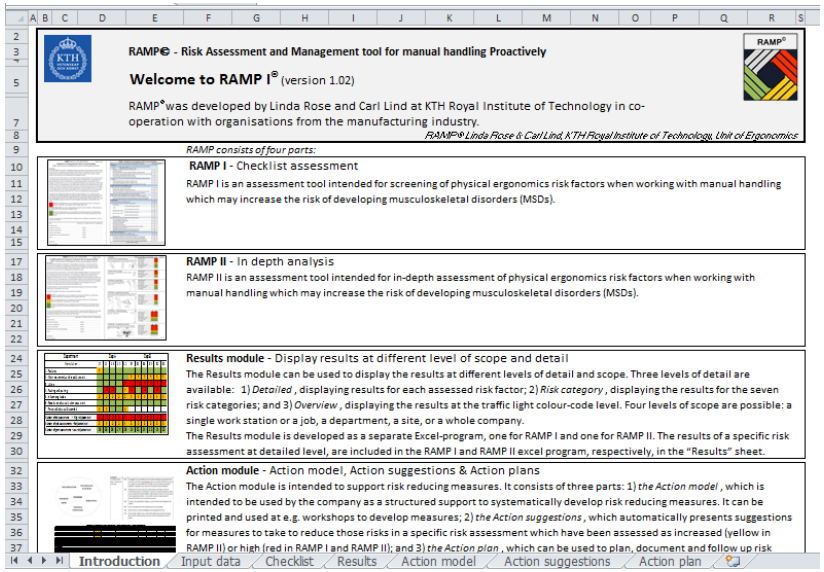
Access to RAMP via KTH's homepage:

ramp.proj.kth.se (English & Swedish)



RAMP© - Risk Assessment and Management tool for manual handling Proactively

Welcome to RAMP I© (version 1.02)

RAMP©was developed by Linda Rose and Carl Lind at KTH Royal Institute of Technology in co-operation with organisations from the manufacturing industry.

RAMP© Linda Rose & Carl Lind, KTH Royal Institute of Technology, Unit of Ergonomics

RAMP consists of four parts:

RAMP I - Checklist assessment

RAMP I is an assessment tool intended for screening of physical ergonomics risk factors when working with manual handling which may increase the risk of developing musculoskeletal disorders (MSDs).

RAMP II - In depth analysis

RAMP II is an assessment tool intended for in-depth assessment of physical ergonomics risk factors when working with manual handling which may increase the risk of developing musculoskeletal disorders (MSDs).

Results module - Display results at different level of scope and detail

The Results module can be used to display the results at different levels of detail and scope. Three levels of detail are available: 1) *Detailed* , displaying results for each assessed risk factor; 2) *Risk category* , displaying the results for the seven risk categories; and 3) *Overview* , displaying the results at the traffic light colour-code level. Four levels of scope are possible: a single work station or a job, a department, a site, or a whole company.

The Results module is developed as a separate Excel-program, one for RAMP I and one for RAMP II. The results of a specific risk assessment at detailed level, are included in the RAMP I and RAMP II excel program, respectively, in the "Results" sheet.

Action module - Action model, Action suggestions & Action plans

The Action module is intended to support risk reducing measures. It consists of three parts: 1) *the Action model* , which is intended to be used by the company as a structured support to systematically develop risk reducing measures. It can be printed and used at e.g. workshops to develop measures; 2) *the Action suggestions* , which automatically presents suggestions for measures to take to reduce those risks in a specific risk assessment which have been assessed as increased (yellow in RAMP II) or high (red in RAMP I and RAMP II); and 3) *the Action plan* , which can be used to plan, document and follow up risk

Introduction | Input data | Checklist | Results | Action model | Action suggestions | Action plan

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Thank you!

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