RAMP: risk management assessment tool for manual handling proactively

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Abstract. This paper presents an IT-based risk management tool called *RAMP*, risk assessment management tool for manual handling proactively. The tool consists of a checklist (RAMP I) and an assessment tool (RAMP II) which can be used to assess physical risk factors associated with manual handling activities in the production industry. The tool provides guidance for action plans and evaluations to promote improvement of occupational health and safety work at company level. Examples of the tool, its development and evaluation are presented.

Keywords. Risk assessment, risk management, intervention, manual handling.

1. Introduction

Despite large efforts to reduce work-related musculoskeletal disorders in Europe, they are increasing (Schneider, 2010).Work-related musculoskeletal disorder causes not only high costs to the society but also loss of production, human suffering and disabilities. In Canada, the total cost due to musculoskeletal disorders have been estimated to 3.4% of the gross domestic product, which is more than 1.4 times the cost of cardiovascular diseases (Coyte et al., 1998). A large portion of the workforce in the EU are daily performing work tasks that requires; manual handling of heavy loads, repetitive hand and arm movements and fixed or constrained body positions (Schneider, 2010), which all have been associated with musculoskeletal disorders (Bernard, 1997; Punnett & Wegman, 2004). The employers in the EU are obliged to conduct a risk assessment if the work requires manual handling. Several assessment tools exist, which can be used to identify and assess physical risks related to manual handling (Takala et al., 2010). Despite this, several companies have developed their own assessment tools (Eklund et al., 2007). One reason for this is that the practitioners´ needs have not enough being considered in the development of physical-ergonomic assessment tools (David et al., 2008).

This project was initiated by two large manufacturing companies which were unable to find a suitable assessment tool that fitted their needs in the assessment of physical risks associated with manual handling (Rose et al., 2011; Lind et al., 2012). Thus, a need for a new practitioner based physical-ergonomic assessment tool that could be used to assess physical risk factors related with manual handling in the manufacturing industry was identified.

The aim of this paper is to describe a newly developed physical-ergonomic risk management tool, called *RAMP* (Risk Management Assessment Tool for Manual Handling Proactively) which can be used to identify and assess physical risk factors related to manual handling activities. The tool is IT-based and provides guidance for action plans and evaluations to promote improvement of occupational health and safety work at company level.

2. Tool development and evaluation

The tool has been developed using a participative iterative process in cooperation between researchers at KTH Royal Institute of Technology and stakeholders in large, medium and small companies from the vehicle, food and logistics industries. Based on an inventory of the companies needs (Rose et al., 2011), prototypes of the tool have been designed and evaluated continuously during the design-process in workshops in Sweden, Denmark and the UK. More than 60 practitioners, including managers, ergonomists, safety delegates, engineers and production personnel have participated in these workshops and the tool has been refined iteratively based on their feedback. The RAMP-tool is based on a combination of epidemiological, psychophysical, physiological and biomechanical studies as well as other physical-ergonomic assessment tools, international standards, Swedish health and safety regulations and expert judgment from a scientific committee (Lind, work in progress).

To be usable, it is important that both experts and non-experts are able to make reliable assessment and doing this within a reasonable amount of time. A recent evaluation of an earlier version of the RAMP-tool (Sandahl, 2013) showed an overall high agreement between assessment conducted by expert and non-experts (75-83%) and high intra-reliability for non-experts (81-87%). The time to conduct an assessment was estimated to about 20-30 minutes, which was found acceptable.

3. The RAMP-tool

The RAMP-tool (see Figure 1) consists of two assessment tools, a checklist (RAMP-I) and an assessment tool (RAMP-II). The result from the assessment is visualized in bars and matrices and forms the base in action plans.

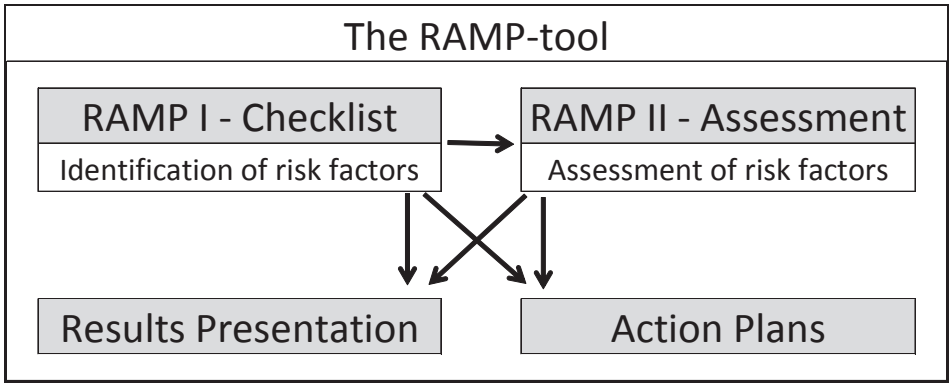


Figure 1. Flow-chart of the RAMP-tool: RAMP-I, RAMP-II, results section and action plans.

The tool covers several risk factors that have been associated with MSDs including;

- awkward and static work postures

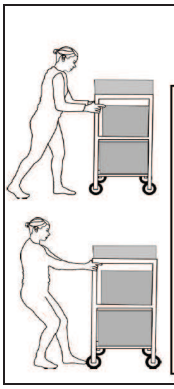
- lifting of loads
- pushing and pulling of loads
- repetitive work
- recovery time and variation
- hand grip
- vibration
- heat and cold stress
- psychosocial factors
- reports of physical demanding work and discomfort

RAMP-I consists of a checklist with dichotomous questions intended for quick screening of manual handling activities to identify whether physical risk factors are present or not. An example of the checklist RAMP-I is presented below (see Figure 2). If a risk factor is identified, a more thorough analysis can be performed in RAMP-II, where the level of detail is higher compared to RAMP-I.

3. Pushing and pulling of loads		
3.2 How large is the exerted pushing or pulling force?		
the initial force exceeds 150 N		
the initial force exceeds 300 N		
the sustained force exceeds 100 N		
the sustained force exceeds 200 N		
3.3 Aggravating factors		
pushing or pulling work carried out more than approximately 100 times per day		

Figure 2. Example from RAMP-I concerning assessment of the force and frequency of pushing and pulling tasks.

An example the assessment table for pushing and pulling tasks in the RAMP-II is presented below (see Figure 3). RAMP-II enables the user to assess a combination of different forces and frequencies as well as a number of aggravating factors (e.g. direction of the force or if the floor is slippery) when assessing a push and pull-task.



Push and pull, inital force: force and frequency

	Times per day	≤ 1	2 - 16	17 - 96	97 - 240	241-480	481-1920
	Times per hour		≤ 2	2,1 - 12	13 - 30	31 - 60	61 - 240
Force	501 - 600 N	8.5	10	10.5	14	14.5	24
	451 - 500 N	7.5	9	9.5	12.5	13	22
	401 - 450 N	6.5	8	8.5	11	11.5	20
	351 - 400 N	6	7	7.5	9.5	10	18
	301 - 350 N	5	6	6.5	8	8.5	16
	251 - 300 N	4	5	5	5	7	14
	201 - 250 N	3	4	4	4	5	12
	151 - 200 N	2.5	2.5	3	3	4	5
	101 - 150 N	2	2	2.5	2.5	3	4
	51 - 100 N	1.5	1.5	2	2	2.5	2.5
	10 - 50 N	1	1	1.5	1.5	2	2

Figure 3. Example from RAMP-II concerning assessment of the force and frequency of pushing and pulling tasks.

The result from the assessment is displayed both as a grand score and as a traffic-light colour code, indicating the degree of severity of the assessed risk factor, ranging from low to high risk. Furthermore, the RAMP-tool gives support of action plans. If a risk factor is detected, the tool provides suggestions for actions needed in order to reduce them. In addition, the

results can be displayed at different levels of detail in order to accommodate different stakeholders' needs; detailed results at work-station level or as overview of the assessment at department, site or company level.

4. Findings and perspectives

The RAMP-tool has been developed based on the practitioners´ needs using a participative ergonomics approach, focusing on the whole risk management process instead of just the identification and assessment of risk. The tool can be used to promote a continuous improvement of occupational health and safety work at company level, with the goal of reducing work related musculoskeletal disorders.

At the conference, both the RAMP-tool and some applied examples of the tool use will be presented.

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