

Evidence-based exposure criteria for work-related musculoskeletal disorders as a tool to assess physical job demands

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Abstract. Despite worldwide attention, musculoskeletal disorders (MSDs) remain a substantial concern at work. To support ergonomists to assess the work-related risk factors for MSDs, several instruments are available. Unfortunately, many of these instruments are not supported by evidence-based exposure criteria for particular MSDs. For effective prevention of MSDs, it is important to know to what extent work-related risk factors are present in the work situation. The Netherlands Center for Occupational Diseases (NCOD) develops evidence-based criteria documents for the assessment of work-related MSDs. The exposure criteria of these documents can be used on a group level to support ergonomists in their assessment of the physical job demands that are associated with work-related MSDs. At the moment the NCOD has exposure criteria for the assessment of 22 work-related MSDs, for instance on the work-relatedness of upper extremity disorders, non-specific low back pain or patellar tendinopathy. The use of these exposure criteria enables ergonomist to better assess the work-related risks of MSDs as a starting point for effective prevention.

Keywords: Prevention, Occupational disease, Threshold limit, Low back pain, Osteoarthritis

1. Introduction

Despite worldwide attention, musculoskeletal disorders (MSDs) remain a substantial concern at work [1]. This slow progress is not for want of trying. For instance, prevention was a theme of The Bone and Joint Decade (2000-2010) of the World Health Organization and in 2007 the European Agency for Safety and Health at Work organized the “Lighten the Load” campaign to prevent work-related MSDs. Despite these initiatives, physical risks at work are as persistent as ever according to the fifth European Working Conditions Survey [2]. Therefore, it is no

surprise that MSDs account for a high proportion of sickness absence from work: over 40 million workers in Europe are affected by MSDs attributable to their work [3]. For low back pain, Punnett et al. [4] calculated that worldwide 37% of low back pain (LBP) is attributed to occupation. Its incidence has consistently been shown to be associated with work that involves high mechanical loads on the low back such as in trunk bending and lifting [5-7]. Moreover, work-related LBP was estimated to cause 818,000 disability-adjusted life years lost annually across the world [4].

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To support ergonomists to assess these work-related risk factors for MSDs, several instruments are available. An example is the review of observational methods by the Finnish Institute of Occupational Health [8]. Unfortunately, many instruments used by ergonomists to assess these risk factors, such as the KIM tools for lifting and pushing and pulling lack scientific evidence for an increased risk of work-related MSDs (<http://www.handlingloads.eu/en/site/>).

For effective prevention of work-related MSDs, it is important to know to what extent work is the main cause of a particular MSD. In the case of an occupational MSD, this means that work is predominantly the cause for the acquired MSD: in that case the work-related attributable fraction is more than 50%. In other words, the work-related fraction exceeds the non-work-related fraction.

Therefore, especially in the case of an occupational MSD, ergonomic measures that reduce the exposure to the risk factors at stake might be effective in reducing the number of work-related MSDs. A better understanding of the relevant physical exposure for a particular MSD and the corresponding threshold limit support an ergonomist in the selection of effective preventive measures to reduce the risk of work-related MSDs. This paper makes a plea to use evidence-based exposure-criteria to assess work-related risk factors for MSDs.

2. Methods

The Netherlands Center for Occupational Diseases (NCOD) (www.occupationaldiseases.nl) develops evidence-based criteria documents for occupational

and insurance physicians to support them in the assessment and notification of occupational diseases in an individual case, for instance for a particular MSD. In contrast to many other countries, the Netherlands do not have a financial compensation system for an acquired occupational disease. A steering committee of the NCOD approves the proposed occupational disease criteria document.

An occupational disease criteria document consists of two parts: a clinical case-definition of the disease and disease-specific exposure-criteria. The exposure-criteria are based on a systematic review of the medical literature and are preferably defined in terms of level, frequency and/or duration of specific job demands.

3. Results

At the moment the NCOD has 22 criteria documents for the assessment of work-related (non-) specific MSDs. Examples are the criteria-document for the work-relatedness of upper extremity disorders [9], non-specific low back pain [10] and patellar tendinopathy ('jumper's knee') [11].

To enhance the application of these criteria documents for ergonomist, the exposure-criteria for similar physical job demands are grouped together, for instance for lifting and carrying (table 1). When a job demand exceeds the exposure-criteria, evidence is available that a worker has an increased risk of developing a work-related MSD.

Table 1

An example of evidence-based exposure-criteria for lifting and carrying, based on the criteria documents for non-specific low back pain and osteoarthritis of the hip and knee of the Netherlands Center for Occupational Diseases

Physical work demands: Lifting and carrying	Musculoskeletal disorder
Lifting or carrying of loads of > 15 kg during at least 10% of an 8 hr working day	Non-specific low back pain
Lifting or carrying of loads of >5 kg, 2 times per minute during at least 2 hours per working day, or at least 1 time per working day loads >25 kg	Non-specific low back pain
Lifting of loads ≥ 10 kg, at least 10 times a week during a minimum of 10 years	Hip osteoarthritis
Lifting of loads ≥ 10 kg, at least 10 times a week during a minimum of 1 year	Knee osteoarthritis

4. Discussion

The use of the evidence-based exposure criteria enables ergonomist to assess the work-related risks of MSDs as a starting point for effective prevention. However, one has to bear in mind that a reduction in exposure of physical job demands does not a priori result in a similar reduction in the risk of the onset or worsening of a work-related MSD [12]. Therefore, the evidence-based exposure-criteria for work-related MSDs have an added value for ergonomic risk assessments, for instance in evaluating the efficacy of preventive measures in terms of a substantial reduction in physical risks for work-related MSDs. An example is given in the evaluation of three ergonomic measures on productivity, physical work demands and workload in gypsum block layers [13].

Another advantage of using occupational disease exposure criteria is that these are regularly reviewed. In general, a criteria document is reviewed every five years. This year, the occupational diseases criteria documents for lateral epicondylitis (tennis elbow) and carpal tunnel syndrome (nerve compression in the wrist) will be revised. This revision will also be based on the literature reviews on work-related risk factors for these two MSDs [14, 15].

Finally, this paper focused on criteria for MSDs. However, an ergonomist also looks at other risk factors at stake, for instance noise or work stress. Besides MSDs, the NCOD also provides criteria documents for noise induced hearing loss and mental illnesses like adjustment disorders, burn-out, and depression. These documents might also be of use for ergonomists.

References

- [1] Wells R. Sounding Board: Why have we not solved the MSD problem? *Work*, (2009) 34, 117–121
- [2] Eurofound. Changes over time – First findings from the fifth European Working Conditions Survey. (2010) April 6th, 2011 www.eurofound.europa.eu/surveys/ewcs/index.htm.
- [3] Bevan S., Quadrello T., McGee R., Mahdon M., Vavrovsky A., Barham L., Fit For Work? Musculoskeletal Disorders in the European Workforce. London: The Work Foundation. (2009)
- [4] Punnett L., Prüss-Stün A., Imel Nelson D., Fingerhut M.A., Leigh J, Tak S-W., Phillips S. Estimating the global burden of low back pain attributable to combined occupational exposures. *American Journal of Industrial Medicine*, (2005).48, 459–469.
- [5] Marras W.S., Lavender S.A., Leurgans S.E., et al. Biomechanical risk factors for occupationally related low back disorders. *Ergonomics*, (1995) 38(2), 377-410
- [6] Norman R., Wells R., Neumann P., Frank J., Shannon H., Kerr M.. A comparison of peak vs cumulative physical work exposure risk factors for the reporting of low back pain in the automotive industry. *Clin. Biomech.*, (1998) 13(8), 561-573.
- [7] Lötters, F., Burdorf, A., Kuiper, J., Miedema, H., Model for the work-relatedness of low-back pain. *Scand. J. Work Environ. Health*, (2003), 29, 431-40.
- [8] Takala E-P., Pehkonen I., Forsman M., et al. Systematic evaluation of observational methods assessing biomechanical exposures at work. *Scand. J. Work Environ. Health*, (2010), 36, 3-24.
- [9] Sluiter J.K., Rest K.M., Frings-Dresen M.H.W. Criteria document for evaluating the work-relatedness of upper-extremity musculoskeletal disorders. *Scand. J. Work Environ. Health*. (2001); 27 suppl 1, 1-102.
- [10] Kuiper, J.I., Burdorf, A., Frings-Dresen, M.H.W., et al. Assessing the work-relatedness of nonspecific low-back pain. *Scand J Work Environ Health*, (2005), 31 (3), 237-243.
- [11] Tiemessen I.T.J., Kuijer P.P.F.M., Hulshof C.T.J., Frings-Dresen M.H.W. Risk factors for developing jumper's knee in sport and occupation: a review. *BMC Research Notes* (2009), 2, 127.
- [12] Lötters F., Burdorf A. Are changes in mechanical exposure and musculoskeletal health good performance indicators for primary prevention? *Int. Arch. Occup. Environ. Health* (2002); 75, 549-561.
- [13] Van der Molen H.F., Kuijer P.P.F.M, Formanoy M., et al. The evaluation of three ergonomic measures on productivity, physical work demands and workload in gypsum block layers. *American Journal of Industrial Medicine* (2010), 53, 608-614.
- [14] Van Rijn R.M., Huisstede B.M., Koes B.W., Burdorf A. Associations between work-related factors and specific disorders at the elbow: a systematic literature review. *Rheumatology* (2009), 48(5), 528-36.
- [15] Van Rijn R.M., Huisstede B.M., Koes B.W., Burdorf A. Associations between work-related factors and the carpal tunnel syndrome--a systematic review. *Scand J Work Environ Health*. (2009), 35(1),19-36.