Musculoskeletal Disorder (MSD) Risk Assessment Tools

A number of risk assessment tools have been developed to quantifying workplace biomechanical and psychosocial factors that may be predictive of MSDs. The MSD Technical Committee has developed a list of tools that have publications in peer-reviewed scientific journals of (1) reliability and (2) predictive value. The tools are listed in categories and then alphabetically. The MSD TC welcomes suggestions for changes to this list and additional references.

Table of Contents

1. General MSD Risk Assessment Tools

1A. Ovako Working Posture Analysis System (OWAS)

The OWAS method was developed by a Finnish steel company of Ovako Oy and is based on ratings of working postures and load: 4 postures for the back, 3 for the arms, and 7 for the lower limbs, and 3 levels for the weight of load handled or amount of force used. Values from the 4 factors are combined to assess 4 categories of risk and recommended actions.

- Category 1: normal postures, which do not need any special attention;
- Category 2: postures must be considered during the next regular check of working methods;
- Category 3: postures need consideration in the near future;
- Category 4: postures need immediate consideration.

Cross-sectional studies:

Burdorf et al. (1991). Postural load and back pain of workers in the manufacturing of prefabricated concrete elements. Ergonomics 34(7) 909-18.

1B. Portable Ergonomics Analysis (PEO)

General description: Direct observations at the workplace are made in real time using a portable personal or hand-held computer and data are accessible for immediate analysis and presentation. Duration and number of events are calculated for postures related to 4 body regions (arms, neck, trunk and knee) as well as for manual handling.

Cross-sectional studies:

Fransson-Hall, C., Bystrom, S. & Kilbom, A., (1996). Characteristics of forearm-hand exposure in relation to symptoms among automobile assembly line workers. American Journal of Industrial Medicine, 29 (1), 15-22.

Leskinen, T., Hall, C., Rauas, S., Ulin, S., Tonnes, M., Viikari-Juntura, E. & Takala, E.P., (1997). Validation of portable ergonomic observation (peo) method using optoelectronic and video recordings. Appl Ergon, 28 (2), 75-83

Murphy et al. (2004) Classroom posture and self-reported back and neck pain in schoolchildren. Applied Ergonomics 35(2): 113-20.

Rolander et al. (2005). Perceived contra observed physical work load in Swedish dentists. Work 25(3): 253-62.

1C. Quick Exposure Check (QEC)

General Description: QEC assesses biomechanical exposures to 4 body regions and allows physical work activities to be assessed in collaboration with the worker. It was designed to be fast, easy to use and not require extensive training. A one-page assessment sheet includes questions for both the practitioner (observer) and the worker to quantify exposures. The exposure levels for four main areas of the body can be scored and these can form a basis for intervention and re-assessment.

Cross-sectional studies:

Choobineh, A.,Tabatabaei, S.H., Abbas Mokhtarzadeh, A., Salehi, M. Musculoskeletal Problems among Workers of an Iranian Rubber Factory. Journal of Occupational Health 49(5):418-423.423.
Mirmohamadi, M., Seraji, J.N., Shahtaheri, J., Lahmi, M.,Ghasemkhani, M. (2004). Evaluation of Risk Factors Causing Musculoskeletal Disorders Using QEC Method in a Furniture Producing Unite Iranian J Publ Health, Vol. 33, No. 2, pp.24-27, 2004.
David, G., Woods, V., Li, G. & Buckle, P., 2008. The development of the quick exposure check (qec) for assessing exposure to risk factors for work-related musculoskeletal disorders. Appl Ergon, 39 (1), 57-69.

2. Upper Extremity Risk Assessment Tools

2A. ACGIH Threshold Limit Value (TLV) for Hand Activity

The TLV for Hand Activity assesses biomechanical risk to the distal upper extremities and is intended for 'mono-task' jobs performed for 4 or more hours per day. The TLV combines 2 factors: (1) average hand activity level based on the frequency of hand exertions and the duty cycle, and (2) normalized peak hand force. Both are scaled from 0-10. The TLV identifies an Action Level (caution) and a higher Threshold Limit Value (immediate action recommended). [The Hand Activity TLV was modified in 2018].

Description:

Threshold Limit Values for chemical substances and physical agents and Biological Exposure Indices. Cincinnati, OH: ACGIH Worldwide; 2019.
Latko WA, Armstrong TJ, Foulke JA, Herrin GD, Rabourn RA, Ulin SS. Development and evaluation of an observational method for assessing repetition in hand tasks. American Industrial Hygiene Association Journal. 1997; 58(4): 278–285.

Cross-Sectional Studies:

Latko, W.A., et al. (1999). Cross-sectional study of the relationship between repetitive work and the prevalence of upper limb musculoskeletal disorders. Am J Ind Med 36(2):248-59.

Franzblau, A., Armstrong, T. J., Werner, R.A., et al. (2005). A Cross-Sectional Assessment of the ACGIH TLV for Hand Activity Level, Journal of Occupational Rehabilitation, 15(1): 57-67.

Spielholz, P., Bao, S., Howard, N. et al. (2008). Reliability and validity assessment of the hand activity level threshold limit value and strain index using expert ratings of mono-task jobs. J Occup Environ Hyg 5(4):250-7.

Prospective Studies:

Gell et al. (2005). A longitudinal study of industrial and clerical workers: incidence of carpal tunnel syndrome and assessment of risk factors. J Occup Rehab 15(1):47-55.

Werner et al. (2005a). Predictors of persistent elbow tendonitis among auto assembly workers. Journal of Occupational Rehabilitation 15(3):393-400.

Werner et al. (2005b). Incidence of carpal tunnel syndrome among automobile assembly workers and assessment of risk factors. J Occup Environ Med 47(10):1044-50.

Werner et al. (2005c). Risk factors for visiting a medical department because of upper-extremity musculoskeletal disorders. Scand J Work Environ Health 31(2):132-7.

Werner et al. (2005d). Predictors for upper extremity discomfort: a longitudinal study of industrial and clerical workers. J Occ Rehab 15(1):27-35.

Violante FS et al. (2007). Carpal tunnel syndrome and manual work: a longitudinal study. J Occup Environ Med 49(11) 1189-96.

Harris C, Eisen E, Goldberg R, Krause N, Rempel D. Workplace and individual factors in wrist tendinosis among blue-collar workers – the San Francisco study. Scandinavian Journal of Work and Environmental Health. 2011; 37(2):86-98.

Bonfiglioli R, Mattioli S, Armstrong TJ, Graziosi F, Marinelli F, Farioli A, et al. Validation of the ACGIH TLV for hand activity level in the OCTOPUS cohort: a two-year longitudinal study of carpal tunnel syndrome. Scandinavian Journal of Work, Environment & Health. 2013; 39(2): 155-163.

Kapellusch JM, Gerr F, Malloy EJ, Garg A, Harris-Adamson C, Bao S, Burt S, Dale AM, Eisen EA, Evanoff B, Hegmann KT, Silverstein B, Thiese MS, Rempel D. Exposure-response relationships for the ACGIH TLV for hand activity level: results from a pooled data study of carpal tunnel syndrome. Scand J Work Environ Health. 2014; 40(6):610-20.

Harris-Adamson C, Eisen EA, Kapellusch J, et al. (2015) Biomechanical Risk Factors for Carpal Tunnel Syndrome: A Pooled Study of 2474 Workers. Occup & Environ Medicine; 72:33-41.

2B. Occupational Repetitive Actions (OCRA)

The OCRA method estimates risk to the upper extremities for repetitive tasks and includes the biomechanical factors of frequency, excessive use of force, awkward upper limb movements and postures, insufficient recovery periods, and net duration of the repetitive tasks.

Description:

ISO 11228-3. Annex C. 2014.

Occhipinti, E. (1998). OCRA: a concise index for the assessment of exposure to repetitive movements of the upper limbs. Ergonomics, 41, 9,1290-1311.

Occhipinti, E., Colombini, D. (2004). The Occupational Repetitive Action (OCRA) Methods: OCRA Index and OCRA Checklist. In Eds. Stanton N. et al., Handbook of human factors and ergonomics methods, Chapter 15, pg 15/1-15/14. CRC Press.

Occhipinti, E., Colombini, D., (2016) A toolkit for the analysis of biomechanical overload and prevention of WMSDs: Criteria, procedures and tool selection in a step-by-step approach. Int J of Industrial Ergonomics, 52: 18-28.

Online/spreadsheet calculations of the OCRA checklist and OCRA index are available here: http://www.epmresearch.org/index.php?fl=2&op=mcs&id_cont=837&idm=837&moi=837

Cross-Sectional Studies:

Occhipinti, E., Columbini, D. (2004). The OCRA method: updating of reference values and prediction models of occurrence of work-related musculo-skeletal diseases of the upper limbs (UL-WMSDs) in working populations exposed to repetitive movements and exertions of the upper limbs. Med Lav 95(4):305-319.

Occhipinti, E., Columbini, D. (2007). Updating of reference values and prediction models of occurrence of work-related musculoskeletal disorders of the upper limbs. Ergonomics 50(11):1727-1739.

Paulsen R, Gallu T, Gilkey D, Reiser R, Murgia L, Rosecrance J. (2015) The inter-rater reliability of Strain Index and OCRA Checklist task assessments in cheese processing. Appl Ergonomics 51:199-204.

2C. Rapid Upper Limb Assessment (RULA)

RULA is a postural targeting method for estimating the postural risks of upper extremity disorders. It uses a graphical approach requiring regular or random sampling of observations to develop a visual distribution of posture.

Description:

McAtamney, L., Corlett, N. (1993). RULA: a survey method for the investigation of work-related upper limb disorders. Applied Ergonomics 24(2):91-99.
Bao, S., Howard, N., Spielholz, P. & Silverstein, B., 2007. Two posture analysis approaches and their application in a modified rapid upper limb assessment evaluation. Ergonomics, 1-19.

Hignett, S. & Mcatamney, L., 2000. Rapid entire body assessment (REBA). Applied Ergonomics, 31, 201-205

Cross-Sectional Studies:

Fountain, L.J. (2003). Examining RULA's postural scoring system with selected physiological and psychophysiological measures. International Journal of Occupational Safety and Ergonomics 9(4):383-92.

Drinkaus, P., Sesek, R.F., Bloswick, D.B. et al. (2003). Comparison of ergonomic risk assessment outputs from Rapid Upper Limb Assessment and the Strain Index for tasks in automotive assembly plants. Work 21(2):165-72.

Breen et al. (2007). An investigation of children's posture and discomfort during computer use. Ergonomics 50(10):1582-92.

Shuval, K., Donchin, M. (2005). Prevalence of upper extremity musculoskeletal symptoms and ergonomic risk factors at a Hi-Tech company in Israel. International Journal of Industrial Ergonomics 35(6):569-81.

2D. Revised Strain Index

The Strain Index estimates biomechanical risk for distal upper extremity disorders (e.g., hand, wrist, forearm and elbow). A job is divided into tasks. For each task and for each hand, 6 job biomechanical factors are classified into categories of exposure by an observer. A datasheet is used to combine the levels in the categories into an overall risk score, the Strain Index. Updated as Revised Strain Index (RSI) in 2016 with descriptions of Composite Strain Index (COSI) and Cumulative Strain Index (CUSI) for complex tasks.

Description:

Moore JS, Garg A. The Strain Index: a proposed method to analyze jobs for risk of distal upper extremity disorders. American Industrial Hygiene Association Journal. 1995; 56(5): 443–458.

Moore, J.S., Garg, A., 1994, Upper extremity disorders in a pork processing plant: relationships between job risk factors and morbidity. American Industrial Hygiene Association Journal, 55, 703-715.

Bao, S., Spieholz, P., Howard, N. & Silverstein, B., 2009. Application of the strain index in multiple task jobs. Applied Ergonomics, 40, 56-68

Garg A., Moore JS, Kapellusch JM., 2016, The Revised Strain Index: an improved upper extremity exposure assessment model. Ergonomics, October 14:1-11 [Epub ahead of print].

Garg A., Moore JS, Kapellusch JM., 2016, The Composite Strain Index (COSI) and the Cumulative Strain Index (CUSI): methodologies for quantifying biomechanical stressors for complex tasks and job rotation using the Revised Strain Index. Ergonomics, Nov 4:1-9 [Epub ahead of print].
Cross-sectional studies:

Stevens Jr., E.M., Vos, G.A., Stephens, J.-P. & Moore, J.S., 2004. Inter-rater reliability of the strain index. Journal of Occupational and Environmental Hygiene, 1, 745-751

Moore, J.S., Rucker, N.P. & Knox, K., 2001. Validity of generic risk factors and the strain index for predicting nontraumatic distal upper extremity morbidity. AIHAJ, 62 (2), 229-35

Rucker, N., Moore, J.S., 2002, Predictive validity of the strain index in manufacturing facilities, Applied Occupational and Environmental Hygiene, 12(1), 63-73.

Drinkaus, P., Sesek, R.F., Bloswick, D.B. et al. (2003). Comparison of ergonomic risk assessment outputs from Rapid Upper Limb Assessment and the Strain Index for tasks in automotive assembly plants. Work 21(2):165-72.

Spielholz, P., Bao, S., Howard, N. et al. (2008). Reliability and validity assessment of the hand activity level threshold limit value and strain index using expert ratings of mono-task jobs. J Occup Environ Hyg 5(4):250-7.

Longitudinal Studies:

Knox, K., Moore, J.S., 2001, Predictive validity of the strain index in turkey processing, Journal of Occupational and Environmental Medicine, 43(5), 451-462.

Garg, A., Kapellusch, J.M., Hegmann, K.T., Thiese, M.S., Merryweather, A.S., Wang, Y.C. & Malloy, E.J., 2014. The Strain Index and TLV for HAL: Risk of lateral epicondylitis in a prospective cohort. Am J Ind Med, 57 (3), 286-302.

Garg A, Kapellusch J, Hegmann K, Wertsch J, Merryweather A, Deckow-Schaefer G, et al. The Strain Index (SI) and Threshold Limit Value (TLV) for Hand Activity Level (HAL): Risk of carpal tunnel syndrome (CTS) in a prospective cohort. Ergonomics. 2012; 55(4): 396-414.

2E. ACGIH Threshold Limit Value (TLV) for Upper Limb Localized Fatigue

The TLV for upper limb localized fatigue is designed to prevent excessive or persistent upper limb (forearm, elbow, shoulder) musculoskeletal fatigue for repetitive work. The TLV curve is based on the force exerted at a % strength (% maximum voluntary contraction (%MVC)) and the duty cycle of work (e.g., the % of time that applied force is greater than 5% MVC). The TLV is based on psychophysical, laboratory, and epidemiologic studies.

Description:

ACGIH. TLVs and BEIs: Threshold Limit Values for chemical substances and physical agents and Biological Exposure Indices. Cincinnati, OH: ACGIH Worldwide; 2017.

Validation:

Bystrom S; Fransson-Hall C: Acceptability of intermittent handgrip contractions based on physiological response. Human Factors 36(1):158–71 (1994).

Frey-Law L; Avin KG: Endurance time is joint-specific: A modeling and meta-analysis investigation. Ergonomics 53(1):109–129 (2010).

Potvin JR: Predicting maximum acceptable efforts for repetitive tasks: An equation based on duty cycle. Human Factors 54(2):175–188 (2012).

2F. The Distal Upper Extremity Tool (DUET)

DUET is an upper extremity risk assessment tool based on fatigue failure theory. Inputs used for analysis of tasks include: 1) an estimate of peak force exertion during the task, and 2) the number of daily repetitions performed. If a worker performs multiple tasks during the day, each task is analyzed as above, and the tool will calculate the total estimated cumulative damage. A probability of a distal upper extremity outcome is provided, based on associations observed in a large cross-sectional study. The tool will also identify the percentage of total damage associated with each task, which provides a basis for prioritizing tasks that may benefit from ergonomic redesign. An online version of the DUET tool can be accessed at http://duet.pythonanywhere.com

Gallagher, S., Schall, Jr., M.C., Sesek, R.F., Huangfu, R. (2018). An Upper Extremity Risk Assessment Tool Based On Material Fatigue Failure Theory. Human Factors, 60(8): 1146-1162. (DOI: 10.1177/0018720818789319).

3. Methods to assess manual materials handling

3A. Lumbar Motion Monitor

The Lumbar Motion Monitor (LMM) is a device that is carried on the back of a worker, like a backpack, and continuously measures the position, velocity, and acceleration of the spine in the sagittal, lateral, and twisting planes. A model was developed to use this data to estimate risk for low back disorders (LBDs).

Description:

Marras, W. S., Allread, G. W., & Ried, R. G. (1999). Occupational low back disorder risk assessment using the lumbar motion monitor. In W. Karwowski & W. S. Marras (Eds.), The Occupational Ergonomics Handbook (pp. 1075-1100). New York: CRC Press.

Cross-Sectional Studies:

Marras, W.S., Lavender, S.A, Leurgans, S., Rajulu, S., Allread, W.G., Fathallah, F., and Ferguson, S.A., (1993), “The Role of Dynamic Three Dimensional Trunk Motion in Occupationally-Related Low Back Disorders: The Effects of Workplace Factors, Trunk Position and Trunk Motion Characteristics on Injury.” Spine, 18(5):617-628.

Prospective studies:

Marras WS, Allread WG, Burr DL, and Fathallah FA, (2000), “Prospective Validation of a Low-Back Disorder Risk Model and Assessment of Ergonomic Interventions Associated with Manual Materials Handling Tasks.” Ergonomics, 43(11):1866-1886.

3B. Revised NIOSH lifting equation (RNLE)

The RNLE is a risk-assessment tool to assess the manual material handling risks associated with lifting and lowering tasks. An equation is used to assess job task variables to determine the Recommended Weight Limit (RWL), a maximum acceptable weight (load) that nearly all healthy employees could lift over the course of an 8-hour shift without increasing the risk low back disorders (LBDs). In addition, a Lifting Index (LI) can be calculated to provide a relative estimate of risk of the existing load versus the RWL. RNLE has been enlarged to analyze cumulative exposure and multi-task jobs (composite, variable and sequential).

Description:

Waters, T. R., Putzanderson, V., Garg, A., & Fine, L. J. (1993). Revised NIOSH equation for the design and evaluation of manual lifting tasks. Ergonomics, 36(7), 749-776.

Waters, T., Putzanderson, V., & Garg, A. (1993). A method for assessing multitask manual lifting jobs using the revised NIOSH lifting equation. Ergonomics of Manual Work, 77-80.

Dempsey, P. G., Burdorf, A., Fathallah, F. A., Sorock, G. S., & Hashemi, L. (2001). Influence of measurement accuracy on the application of the 1991 NIOSH equation. Applied Ergonomics, 32(1), 91-99.

Dempsey, P. G. (2002). Usability of the revised NIOSH lifting equation. Ergonomics, 45(12), 817-828.

Waters, T., Lu, M., Occhipinti, E. (2007). New procedure for assessing sequential manual lifting jobs using the Revised Niosh Lifting Equation. Ergonomics, 50; 11; 1761–1770.

Waters,T., Occhipinti,E., Colombini,D., Alvarez-Casado,E., Fox, R. (2016). Variable Lifting Index (VLI): A New Method for Evaluating Variable Lifting Tasks. Human Factors, 58: 695-711

Occhipinti, D., Colombini, E., Alvarez-Casado, E., Waters, T. (2012)
Manual lifting, a guide to study of simple and complex lifting tasks
CRC Pres-Taylor&Francis.

Lu, M. L., Putz-Anderson, V., Garg, A., & Davis, K. G. (2016). Evaluation of the impact of the revised National Institute for Occupational Safety and Health Lifting Equation. Human Factors, 58(5), 667-682.

The equation applications manual is available here:
http://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf

Online/spreadsheet calculations of the equation (LI, CLI and VLI) are available here:
http://personal.health.usf.edu/tbernard/ergotools/index.html
http://www.epmresearch.org/index.php?fl=2&op=mcs&id_cont=837&idm=837&moi=837

Cross-Sectional Studies:

Waters, T.R., Baron, S. L., Piacitelli, L. A., Anderson, V. P., Skov, T., Haring-Sweeney, M., Wall, D. K., Fine, L. J. , (1999) Evaluation of the revised NIOSH lifting equation – A cross- sectional epidemiologic study. Spine 24 (4):386-394.

Marras, W.S., Fine, L. J., Ferguson, S. A., Waters, T. R. (1999), The effectiveness of commonly used lifting assessment methods to identify industrial jobs associated with elevated risk of low-back disorders. Ergonomics 42 (1):229-245.

Dempsey, P. G. (2003). A survey of lifting and lowering tasks. International Journal of Industrial Ergonomics, 31(1), 11-16.

Battevi, N., Pandolfi, M., Cortinovis, I. (2016). Variable Lifting Index for Manual-Lifting Risk Assessment: A Preliminary Validation Study. Human Factors 58: 712-725.

Waters, T. R., Lu, M. L., Piacitelli, L. A., Werren, D., & Deddens, J. A. (2011). Efficacy of the revised NIOSH lifting equation to predict risk of low back pain due to manual lifting: Expanded cross-sectional analysis. Journal of Occupational and Environmental Medicine, 53(9), 1061–1067.

Prospective Studies:

Garg, A., Boda, S., Hegmann, K. T., et al. (2014). The NIOSH lifting equation and low-back pain, part 1: association with low-back pain in the Backworks prospective cohort study. Human factors, 56(1), 6-28.

Kapellusch, J. M., Garg, A., Boda, S.,et al. (2014). Association between lifting and use of medication for low back pain: Results from the backworks prospective cohort study. Journal of Occupational and Environmental Medicine, 56(8), 867-877.

Lu, M. L., Waters, T. R., Krieg, E., & Werren, D. (2014). Efficacy of the revised NIOSH lifting equation to predict risk of low-back pain associated with manual lifting: A one-year prospective study. Human factors, 56(1), 73-85.

Garg, A. & Kapellusch, J.M. (2016) The Cumulative Lifting Index (CULI) for the Revised NIOSH Lifting Equation: Quantifying risk for workers with job rotation.

Pandalai SP, Wheeler WW, & Lu M-L. Non-chemical risk assessment for lifting and low back pain based on Bayesian Threshold Models. Safety and Health at Work 2017; 8:206-211.

Battevi N, Pandolfi M, & Cortinovis I. Variable Lifting Index for manual-lifting risk assessment: A preliminary validation study. Human Factors 2016; 58(5):712-25.

3C. Psychophysical Lifting/Lowering Tables (Liberty Mutual)

Psychophysical theory examines the relationship between the strength of a perceived sensation (S) and the intensity of a physical stimulus (I). This theory has been used in manual materials handling tasks to establish the maximum acceptable weight or force for a wide variety of lifting, lowering, pushing and pulling tasks (among others). Liberty Mutual Insurance Company has published comprehensive tables for this type of strength assessment.

Description:

Snook, S. H., and Ciriello, V. M. (1991). The design of manual handling tasks: revised tables of maximum acceptable weights and forces. Ergonomics, 34(9), 1197-1213.

Online/spreadsheet calculations of the tables are available here:
http://personal.health.usf.edu/tbernard/ergotools/index.html

Cross-Sectional Studies:

Snook, S.H., The design of manual handling tasks, Ergonomics, 21:12-963-985, 1978.

Marras, W.S., Fine, L. J., Ferguson, S. A., Waters, T. R. (1999), The effectiveness of commonly used lifting assessment methods to identify industrial jobs associated with elevated risk of low-back disorders. Ergonomics 42 (1):229-245.

Dempsey, P. G. (2003). A survey of lifting and lowering tasks. International Journal of Industrial Ergonomics, 31(1), 11-16.

3D. Lifting Fatigue Failure Tool [LIFFT]

The LiFFT estimates a “daily dose” of cumulative loading on the low back using fatigue failure principles. Three variables are necessary to derive the cumulative load associated with a lifting task: the load weight, the maximum horizontal distance from the spine to the load, and the number of repetitions for tasks performed during the workday. For multiple lifting tasks, the cumulative damage estimate for each can be summed together to estimate the cumulative daily spine load. LiFFT can be downloaded at: http://eng.auburn.edu/research/centers/occupational-safety-ergonomics-injury-prevention/index.html

Description and Validation:

Gallagher, S., Sesek, R.F., Schall Jr., M.C. Huangfu, R., Development and validation of an easy-to-use risk assessment tool for cumulative low back loading: The Lifting Fatigue Failure Tool (LiFFT), Applied Ergonomics (2017), http://dx.doi.org/10.1016/j.apergo.2017.04.016

4. Methods to Assess Psychosocial Stress

4A. Effort-Reward Imbalance Model

The effort-reward imbalance model aims to support the understanding of how social and psychological factors contribute to injury and disease. The construct is based on "social reciprocity" and the theory that failed reciprocity resulting from high effort with low rewards will elicit negative emotions and sustained stress responses. Conversely, appropriate social rewards will promote wellbeing health and survival. Rewards are characterized by financial, esteem and career opportunities, including job security. There are 3 psychometric scales assessed including effort, reward and over commitment. There are 2 versions of the ERI questionnaire including a long version (23 Likert scaled items) and the short version (16 items), more commonly used in large epidemiological studies.

Long Version Validity:

Rantanen, J., Feldt, T., Hyvönen, K., Kinnunen, U. and Mäkikangas, A. (2012). Factorial validity of the effort-reward imbalance scale: evidence from multi-sample and three-wave follow-up studies. International Archives of Occupational and Environmental Health, 86(6): 645-56.

Siegrist, J., Starke, D., Chandola, T., Godin, I., Marmot, M., Niedhammer, I. and Peter, R. (2004). The measurement of Effort-Reward Imbalance at work: European comparisons. Social Science & Medicine, 58 (8), 1483-1499.

Short Version Validity:
Leineweber, C., Wege, N., Westerlund H., Theorell, T., Wahrendorf, M. and Siegrist, J. (2010). How valid is a short measure of effort-reward imbalance at work? A replication study from Sweden. Occupational and Environmental Medicine 67(8): 526-31.

Siegrist, J., Wege, N., Pühlhofer, F. and Wahrendorf, M. (2009). A short generic measure of work stress in the era of globalization: effort-reward imbalance. Int Arch Occup Environ Health, 82(8):1005-13.

Useful Link: (including survey download):

http://www.uniklinik-duesseldorf.de/startseite/institute/institut-fuer-medizinische-soziologie/forschung-research/the-eri-model-stress-and-health/measurement/

4B. Copenhagen Psychosocial Questionnaire (COPSOQ)

The Copenhagen Psychosocial Questionnaire was developed to provide work environment professionals and researchers a standardized and validated questionnaire to assess a variety of psychosocial factors. There is now a second version and, like the first version, the COPSOQII has 3 versions of differing lengths, the longest of which is recommended for researchers and the shortest version recommended for the workplace. The COPSOQII assesses work demands, organization, work relationships and leadership, the work-individual relationship, health and well-being, personality, and offensive behaviors.

Validation:

Pejtersen, J. H., Kristensen, T. S., Borg, V., & Bjorner, J. B. (2010). The second version of the Copenhagen Psychosocial Questionnaire. Scandinavian journal of public health, 38(3 suppl), 8-24.

Bjorner, J. B., & Pejtersen, J. H. (2010). Evaluating construct validity of the second version of the Copenhagen Psychosocial Questionnaire through analysis of differential item functioning and differential item effect. Scandinavian journal of public health, 38(3 suppl), 90-105.

Prospective Studies:

Rugulies, R., Aust, B., & Pejtersen, J. H. (2010). Do psychosocial work environment factors measured with scales from the Copenhagen Psychosocial Questionnaire predict register-based sickness absence of 3 weeks or more in Denmark. Scandinavian journal of public health, 38(3 suppl), 42-50.

4C. Karasek Job Content Questionnaire

This model predicts that mental strain results from the interaction of job demands and job decision latitude. The combination of low decision latitude and heavy job demand has been associated with mental strain. and job dissatisfaction. The JCQ is designed to measure scales assessing psychological demands, decision latitude, social support, physical demands, and job insecurity.

Reviews:

Häusser, J. A., Mojzisch, A., Niesel, M., & Schulz-Hardt, S. (2010). Ten years on: A review of recent research on the Job Demand–Control (-Support) model and psychological well-being. Work & Stress, 24(1), 1-35.

Van der Doef, M., & Maes, S. (1999). The job demand-control (-support) model and psychological well-being: a review of 20 years of empirical research. Work & stress, 13(2), 87-114.

Karasek, R. A.. (1979). Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. Administrative Science Quarterly, 24(2), 285–308. http://doi.org/10.2307/2392498

Prospective Studies:

Kivimäki, M., Leino-Arjas, P., Luukkonen, R., Riihimäi, H., Vahtera, J., & Kirjonen, J. (2002). Work stress and risk of cardiovascular mortality: prospective cohort study of industrial employees. BMJ, 325(7369), 857.

Cheng, Y., Kawachi, I., Coakley, E. H., Schwartz, J., & Colditz, G. (2000). Association between psychosocial work characteristics and health functioning in American women: prospective study. BMJ, 320(7247), 1432-1436.

Canivet, C., Choi, B., Karasek, R., Moghaddassi, M., Staland-Nyman, C., & Östergren, P. O. (2013). Can high psychological job demands, low decision latitude, and high job strain predict disability pensions? A 12-year follow-up of middle-aged Swedish workers. International archives of occupational and environmental health, 86(3), 307-319.