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The relationship between psychosocial work factors, employee health and organisational production
– a systematic review

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WORKING PAPER 2012:8

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ISSN 1651-1166

The relationship between psychosocial work factors, employee health and organisational production – a systematic review[§].

by

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April 16, 2012

Abstract

The aim of this systematic review is to establish the research evidence of the relationship between the psychosocial work environment and employee health and its impact on organisational production. Searches in several databases were performed in September 2009. Previously known studies were also included. A total of 17 studies were identified using these methods. Study quality was evaluated using the EPHPP quality assessment tool. We found limited evidence that psychosocial work factors and employee health are predictors of production loss. The evidence was clearest with regard to job strain and musculoskeletal pain. Although there was some evidence for the impact of psychosocial work factors and the health of employees on self-rated performance, there was no evidence for any specific factors or health problems. The research into how psychosocial work factors and employee health affect organisational production still suffers from the fact that there are only few and low-quality studies. Longitudinal studies that evaluate the factors that create healthy organisations are needed.

Keywords: Evidence-based, organisational production, psychosocial factors, working conditions, healthy organisations, healthy workplaces
JEL-codes: I12, I15, J28, J81, L25, M12

[§] We are very grateful for the comments on this paper from Marcus Eliasson, Per Lytsy and the seminar participants at IFAU. This project was made possible by grants from IFAU.
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1 Introduction

Developments in the global market with increased competition from national as well as international companies have contributed to major changes in the labour market. Downsizing, outsourcing, short-term contracts, job insecurity and less stable work environments are a result of these changes, which may have negative effects on employee loyalty, morale, and motivation in high-income countries with mature economies (Cooper, 1999). These changes are also a possible explanation for increased stress among employees and increased levels of sickness absence in Sweden (Härenstam, 2005). Organisations in all countries often face problems with costs these days as a result of absenteeism, accidents, employee turnover and lost productivity, which could all be related to problems in the work environment (Lowe, 2004). By creating a work organisation that promotes well-being among employees and increases individual performance as well as company efficiency and productivity it could be possible to compete in a global market with a more efficient use of existing resources. According to the Luxembourg Declaration, organisations depend on healthy, motivated employees for their success (European Network for Workplace Health Promotion, 2005); a statement that is part of the theory of healthy organisations.

1.1 Healthy organisations

The problems associated with work-related illness have led to a discussion about healthy organisations; i.e. about organisations that have a work environment that contributes to employee health and high performance (Lowe, 2004), and how to create such a work environment. According to the theory of healthy organisations, it is possible to combine the goal of obtaining profits with investments in employee health. Previous theories were built on the assumption that this was not possible; if resources were devoted to employee health, then fewer resources would be left to contribute to company profits (Shoaf et al., 2004). Over the years research has focused on organisational effectiveness and how to improve productivity. Effectiveness is often defined as meeting profit, production and service goals. Jaffe (1995) extended organisational effectiveness with another dimension; how organisations treat their employees, and how health, well-being and effectiveness are connected. These two parts are included in his definition of organisational health, e.g. healthy organisations. A healthy organisation will, according to Jaffe, not only create health for the people that work in the organisation, but also for the surrounding environment. This kind of workplace provides organisational resources that could help employees handle both job and life stressors (Kelloway & Day, 2005).

The European Union has taken action to emphasise the importance of focusing on workers' health and well-being at work (Commission of the European Communities, 2002) and has also established a European Network for Workplace Health Promotion with the aim of identifying examples of good practice of workplace health promotion (Menckel, 1999). The fact that both the employees' physical and psychological health are affected by their work environment is known and summarised in several systematic reviews (Ariens et al., 2001; Bongers et al., 2002; Stansfeld & Candy, 2006; Van der Doef & Maes, 1999; Way & MacNeil, 2006). This supports the first part of a healthy workplace; a healthy organisation contributes to employee health. The second part of the theory; that a healthy organisation contributes to high performance, has been investigated but the results from studies are contradicting. As studies have not found a direct link, Parker et al. (2003) have looked at potential mediators in a meta-analysis and found an indirect link between perceptions of the psychological climate and work performance through employees' attitudes or motivation. However, an employee's production is also affected by his or hers ability to perform at work, which has been shown in several studies (Boles et al., 2004; Burton et al., 2005; Lerner et al., 2003). It might be that a link between the psychosocial work environment and worker performance is explained by the health state of the employee. A healthy workplace is then assumed to create a work environment that contributes to healthy employees, which in turn has a positive impact on their performance. However, there are several questions that remain and needs to be answered. Does the psychosocial work environment directly affect production? Is there an indirect effect of the psychosocial work environment on production through employee health? Do psychosocial work factors moderate the effect of employee health on production? The nature of this relationship still needs to be clarified.

Employee production is often measured as self-rated performance, supervisor-rated performance, objectively with data from company registers or as production loss; i.e. as reduced performance due to health-related problems. The latter is often measured with questionnaires and includes reduced production at work due to health problems and/or production loss due to absence (Mattke et al., 2007). The assumption is that employees that have health problems reduce their ability to produce and therefore affect company output either by working with reduced ability or by being absent from work. Health problems are defined in different ways but include problems due to stress, musculoskeletal pain, psychological ill-health, lifestyle risks and others. Production loss measures employees reduced production in relation to their normal production rate and can be used to calculate the

cost for companies for the total production loss. Performance, however, focus on employees actual production rather than if their performance is reduced or not.

Employees' health could be affected by both the psychosocial and physical work environment. In this study we are especially interested in investigating the psychosocial work environment and its effect on employee health and organizational production. The psychosocial work environment is the result of an interaction between the work organization and the individual. It is "those factors that are determined by work content, its organization and the social relationships at the workplace" (Eriksson, 1996). It is also mentioned as the non-physical aspects of a workplace and includes, besides the organization and social relationships, management (Jeding, 1999). It has also been expressed as "the sociostructural range of opportunities that is available to an individual person to meet his or her needs of well-being, productivity, and positive self-experience" (Siegrist & Marmot, 2004). This concept incorporates how the individual is affected by the direct environment, but also how the individual affects the working environment him or herself.

There is reason to believe that a good work environment contributes to healthy employees that in turn affect organisational production, or that a good work environment together with healthy employees contributes to a productive organisation. Studies have investigated these relationships and found for example an indirect link between psychosocial work factors and production loss through the health of the employees (Lohela Karlsson et al. 2010, D´Souza et al. 2006). A systematic review would contribute to the research field by examining this area. The aim of this systematic review was to establish the research evidence of the relationship between the psychosocial work environment and employee health and the relationship to organisational production.

2 Method

A systematic literature search using Medline, PsycINFO, Web of Science, and Econlit was performed to identify original studies investigating the relationship between psychosocial work factors, employee health and organisational production. By production, in this particular study, we are referring to productivity, performance and production loss. The search included studies in English that have been published in peer-reviewed scientific journals. Each database was searched up to 1st September 2009, without using a specific start date and using a combination of search terms (MeSH and keywords) related to psychosocial factors at work,

factors related to employee health and organisational outcomes (Table 1). A total of 2,264 studies were identified in the search.

Table 1 Search terms for literature search

psychosocial working conditions OR psychosocial work factors OR psychosocial work environment OR psychological work factors OR organizational climate OR social support OR job demand OR leadership OR work climate OR workload
AND
well-being OR employee health OR cardiovascular disease OR (back pain or neck pain) OR shoulder pain OR worker health OR workplace health OR health-related quality of life OR burnout OR depression OR mental health
AND
Productivity OR efficacy OR performance OR productivity loss OR production loss OR effectiveness

In the second phase, two of the authors scrutinised all of the titles and abstracts to identify all relevant studies fulfilling the inclusion criteria. The inclusion criteria were that the studies had to (a) include an investigation of the relationship of all three factors: psychosocial work factors, employee health, and production; (b) measure production directly or indirectly using production loss, performance or productivity regardless of how they have defined the concepts; (c) use production (defined as productivity, performance and production loss) as the dependent variable; (d) include empirical studies involving working employees; (e) be published in peer-reviewed international scientific journals and (f) be written in English. Studies were excluded based on the following criteria: (a) studies measuring sick leave or presenteeism without analysing this within the concept of production loss.

158 published studies of relevance were identified. These studies were then assessed independently by two reviewers. After full-text reading of the remaining studies, 15 articles met the inclusion criteria and were included (Figure 1). In the final stage, published studies known to the authors were included. This resulted in two additional studies. In total 17 studies were included in this review.

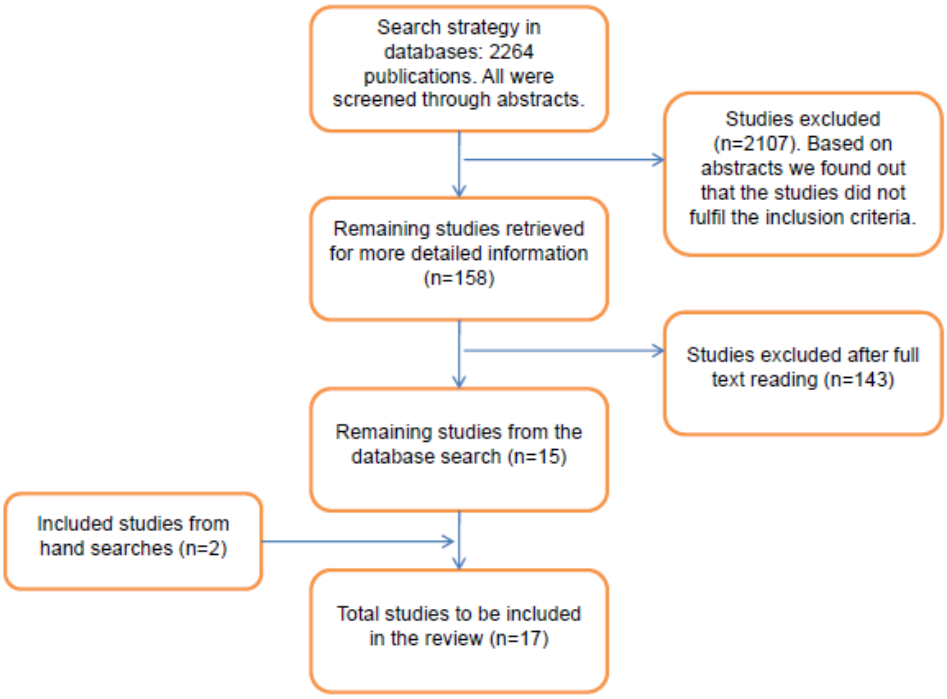

Figure 1 Flow chart for inclusion of studies

2.1 Quality assessment

The protocol used to extract data from the studies was a standard protocol from the McMaster University used to assess the methodological quality of public health promotion studies, called Effective Public Health Practice Project (EPHPP) (Thomas et al., 2004). The protocol consisted of several components; selection bias, study design, confounders, blinding, data collection methods, and withdrawals and drop-outs. Each component together with the other components assessed the quality of the study. Before the assessment started, test assessments were made by two of the reviewers to measure inter-rater reliability. Overall agreement was 88% (15 out of the 17 studies) indicating an acceptance of the protocol for this study. Disagreements between the two reviewers were discussed at a consensus meeting with a senior researcher who was experienced in systematic reviews.

Each study was assessed using the EPHPP checklist and rated according to methodological quality. The methodological quality of each component was rated as strong, moderate or weak. The EPHPP quality assessment dictionary developed for the protocol was used as the basis for the quality rating of each component. In the final stage an overall assessment of quality was made. A study was rated as *high quality* if it received four strong ratings and no weak ratings, *moderate quality* if less than four components were rated as strong and one component was rated as weak, and *weak quality* if two or more components were rated as weak.

2.2 Evidence grading

The total level of evidence was graded according to the following requirements which had been used previously (Statens beredning för medicinsk utvärdering, 2003):

- Strong – at least two studies with strong quality.
- Moderate – one study with strong quality and at least two studies with moderate quality.
- Limited – at least two studies with moderate quality, or at least five studies with weak quality.
- No evidence – other results than stated above, or results pointing in different directions.

3 Results

The searches resulted in 17 articles that fulfilled the inclusion criteria. These are presented in the appendix. Out of these, nine articles examined the outcome of productivity loss or reduced production at work, seven examined different aspects of performance, and one investigated organisational productivity. One of the studies (Byrne & Hochwarter, 2006) investigating performance contained three different populations with separate analyses. These were evaluated separately. Three of the studies had a prospective design (Bakker et al., 2004; Hagberg et al. 2007; Li et al., 2006). All the others were cross-sectional. The articles included between 73 and 16,001 employees and had data from employees working in hospital, home-care, computer users, construction, manufacturing and service industries, or included several sectors in their study. Job demands and job control were the most common estimate of psychosocial work factors and were used in seven of the studies. Six studies were rated as having moderate quality and ten were rated as having weak quality (see Table A 1 and Table A 2 in the appendix). Two of the studies in Byrne and Hochwarter (Byrne & Hochwarter, 2006) were rated as moderate and one as weak. Few of the articles investigated the same psychosocial work factors and health outcomes with the different organisational outcomes.

3.1 Production loss

Nine studies used loss of production at work due to health problems as a measure of the employees' ability to perform (Alavinia et al., 2009; D'Souza et al., 2006; Hagberg et al., 2002; Hagberg et al., 2007; Li et al., 2006; Martimo et al., 2009; Meerding et al., 2005; Musich et al., 2006; van den Heuvel et al., 2007) (Table A 1). It was measured most commonly in terms of sickness presenteeism, but one study used sickness absence as an estimate (D'Souza et al., 2006). Production loss was used as an estimate both for reduced performance due to a specific health problem (Hagberg et al., 2002; Hagberg et al., 2007; Li

et al., 2006; Martimo et al., 2009; Meerding et al., 2005; van den Heuvel et al., 2007) and reduced performance due to general health problems (Alavinia et al., 2009; D'Souza et al., 2006; Musich et al., 2006). All studies except D'Souza (2006) used health and psychosocial work factors as predictors of production loss. D'Souza (2006) used health as a mediating variable between psychosocial work factors and production loss.

Three studies (Hagberg et al., 2002; Hagberg et al., 2007; Meerding et al., 2005) examined the relationship between job demands, job control, musculoskeletal disorders and production loss (measured as presenteeism). In two cross-sectional studies (Hagberg et al., 2002; Meerding et al., 2005) the occurrence of musculoskeletal complaints and job strain were also associated with production loss in computer workers and construction workers, but in Hagberg et al.'s study (2002) the results were only applicable to women. However, in Hagberg et al.'s longitudinal study (2007) using the same study population, job demands, job control and job strain were found to be risk factors for increased productivity loss among the whole sample. In Martimo et al.'s study (2009) job strain was also associated with increased productivity loss among employees with upper extremity symptoms, but only among younger employees. A combination of job strain and pain contributed most to production loss (Martimo et al., 2009) as well as pain intensity and high effort (van den Heuvel et al., 2007). Li et al. (2006) found that low or medium control decreased the odds of production loss, while high depression levels increased the odds.

Work/life imbalance, ineffective management/leadership, poor work conditions and back pain were associated with production loss (Musich et al., 2006). Low job control and health problems were found to be risk factors for production loss in another study (Alavinia et al., 2009).

In conclusion there is limited evidence that psychosocial work factors and health are associated with production loss irrespective of the study population, and the way in which the different factors relate to production loss differs. There is limited evidence that both the psychosocial work environment and musculoskeletal pain syndromes are associated with production losses independently among a population with musculoskeletal disorders. The evidence is clearest with relation to the demand/control factors at work (job strain). For a population with non-specific health problems there was no evidence of how work factors and health affect production loss due to the low number of studies. There is not enough evidence to show the mediating effect of health or other health problems.

3.2 Performance

The searches resulted in seven studies that had investigated the relationship between psychosocial work factors, employee health and performance (Table A 2). Performance was measured as self-rated with: extra- and in-role performance (Bakker et al., 2004), citizenship behaviour (Byrne & Hochwarter, 2006), self-assessed performance (Donald et al., 2005; Parker & Kulik, 1995; Rego & Cunha, 2008), perceived effectiveness and work intensity (Byrne & Hochwarter, 2006); as supervisor-rated performance (Byrne & Hochwarter, 2006; Park et al., 2004; Parker & Kulik, 1995) or as objective performance with financial data (Bakker et al., 2008). Four used health as a mediating variable (Bakker et al., 2004; Bakker et al., 2008; Parker & Kulik, 1995; Rego & Cunha, 2008). The studies that have been included with a performance outcome were rated as having moderate or weak quality, mainly due to the cross-sectional design.

3.2.1 Supervisor-rated performance

High social support was related to low depression and high job performance (Park et al., 2004). High social support was also found to be related to supervisor-rated job performance in another study (Parker & Kulik, 1995). This relationship was not affected by the employees' mental health. People who perceived low levels of organisational support and had high levels of chronic pain had lower performance levels than people with chronic pain who perceived the organisational support as being high (Byrne & Hochwarter, 2006) (sample 3). Job resources, which included social support, was also found to be a predictor for job performance mediated by disengagement (a component of burnout) (Bakker et al., 2004). Performance in this study (Bakker et al., 2004) was objective and collected from a management information system.

3.2.2 Self-related performance

Greater access to resources and information and better employee well-being were associated with higher performance among the employees (Donald et al., 2005). A relationship between personal development and opportunities for learning, the spirit of camaraderie and performance was found, a relationship that was mediated by affective well-being (Rego & Cunha, 2008). The spirit of camaraderie covers the relationships between co-workers and the social climate within the organisation. Parker and Kulik (1995) found that emotional exhaustion mediated the relationship between social support and self-rated performance, while Byrne & Hochwarter (sample 1 and 2) (2006) found that people who perceived low

levels of organisational support and had high levels of chronic pain had lower performance levels than people with chronic pain who perceived the organisational support to be high.

In conclusion there is limited evidence that performance at work is affected by both psychosocial work factors and health but the relationship differs between psychosocial work factors and different health-problems. There is limited evidence that emotional exhaustion does not mediate the relationship between social support and supervisor-rated performance. There is limited evidence that mental health mediates the relationship between social support and self-rated performance as well as objective performance. There is also limited evidence to indicate that support moderates the relationship between pain and self-rated performance.

3.3 Organisational productivity

Taris and Schreurs (Taris & Schreurs, 2009) investigated whether there was a relationship between emotional exhaustion and organisational productivity, and whether different psychosocial work factors contributed to an explained variance in the different productivity measures at an organisational level (Table A 2). Emotional exhaustion was related to three out of four indicators of productivity: client satisfaction, personnel costs, and productivity. Demand, control and support did not contribute to a better explanation for productivity levels.

It is not possible to draw any conclusions of evidence for a relationship between work factors, health and productivity due to the limited number of studies.

4 Discussion

The aim of this study was to establish the research evidence for the relationship between the psychosocial work environment and employee health and its impact on organisational production. Few studies were found that investigated the same factors, and the majority of the studies suffered from methodological shortcomings. Therefore, the overall evidence for the relationship between psychosocial work factors, employee health and production loss is defined as limited. The relationships between psychosocial work factors, employee health and performance differ between the various measures of performance. The most common reason for the low-quality rating of the different studies was the cross-sectional design and a low response rate.

4.1 Methodological considerations

Searches were performed in several databases, covering medicine, social science, economics and psychological journals to identify as many published papers of relevance as possible. Even though searches have been thoroughly performed and several search terms have been

used, there is always a risk for selection bias. Therefore, there might be some studies within this field that were not found. However, using several different keywords, MeSH terms and several databases probably minimised this methodological problem. The results in this study only pertain to the search terms that were used. Even though several generic concepts were used there is a risk that some studies relevant to the area were not identified. One problem could be the wide array of terms used within the same area. This is especially common within psychosocial work environment studies were different dimensions within a specific concept are used and measured with different questionnaires. The decision to exclude studies in languages other than English and the criteria to exclude articles, reports and other studies not published in peer-reviewed scientific journals might have caused publication bias. However, we aimed at identifying high-quality international peer-reviewed studies investigating this area, and the criteria were therefore set to ensure this.

4.2 Reviewed studies

Few studies were found that investigated the relationship between the psychosocial work environment, employee health and organisational production. The majority of them were rated as being of weak quality. It is important to note that the criteria used to assess the methodological quality of the studies in this review only pertain to the aim of this study and are partly affected by the protocol chosen. In other aspects these studies may well be of a higher quality. The majority of the studies had a cross-sectional design, which makes it difficult to draw conclusions about the causal relationships of the factors that are being investigated. A number of studies measured the relationship between work demands, work control, pain and production loss. However, only one of the studies was rated with moderate quality and three with weak quality, which, according to the overall evidence grading, is not enough to conclude a limited level of evidence. It is also not clear how job control is related to production loss. The studies have found that low control increases production loss in a general working population (Alavinia et al., 2009) and among employees with forearm and hand problems (Hagberg et al., 2007). Li et al. (2006) found that low and medium control decreased the odds of production loss among employees with arthritis. No relationship was found in a cross-sectional study among employees with upper extremity disorders (Hagberg et al., 2002) or with production loss measured as sickness absence (D'Souza et al., 2006). This inconclusive association could be a result of different study populations and measures of production loss. A similar finding was obtained when estimating the results between social support and performance. Social support was measured both as colleague and supervisor

support, while performance was measured as self-rated, supervisor-rated and collected from management systems. Mental health was found as a mediator between general social support and self-rated performance (Bakker et al., 2004; Donald et al., 2005; Parker & Kulik, 1995) but not between support and supervisor-rated performance (Park et al., 2004; Parker & Kulik, 1995). Mental health mediated a relationship between support from colleagues and objective performance (Bakker et al., 2008). This suggests that control could have different impacts on different populations and different kinds of production loss. It also suggests that resources have different significance depending on how performance is measured. Even though this review suggests that both the work environment and employees' health are important for their ability to perform at work, there is still a need for studies that investigate and clarify how these two important factors affect the ability to perform.

There are other studies than those included in this review that have included psychosocial work factors, employee health and measures of performance in the same study. However, these studies did only investigate how health and the work environment independently impacted organisational production or were performed on a non-working population. A few of them investigated the relationship at an organisational level with mixed findings. Anderzen and Arnetz (2005) found a relationship between work factors and health, but did not find any significance between work factors and organisational productivity. Arnetz et al. (Arnetz, 2007) found that a change in work climate and work tempo were significantly related to a change in mental health, while a change in participatory management and goal clarity were related to a change in efficacy. Vinberg et al. (2008) found that respectful leadership, creative work, decision latitude and team spirit were significantly related to both health and performance, while other factors were correlated to either health or performance. In a study on military students, an indirect relationship was found between demands and performance through health (Lang et al., 2007). Even though these studies did not meet the inclusion criteria in this study, they show similar findings to the results in this review; that the psychosocial work environment is related to both employee health as well as performance. As Jaffe (1995) concludes, healthy employees are not the only factor determining organisational effectiveness. It is also affected by strategies, technology and structures. But having healthy employees is important for companies to further optimise the use of resources to improve productivity.

One challenge with performing a systematic review within a multidisciplinary field is the use of different concepts both within the specific research areas but also within the different subject areas. Even though research in for example psychosocial work environment is

dominated by a few measures, there are several other factors that are under study. This was demonstrated in the results from this review. Not only were different factors measured, different kinds of questionnaires were used to collect the information. This affects the ability to draw evidence-based conclusions concerning the relationships under study. For this reason it would be desirable if a limited number of questionnaires were used to collect information on a specific factor. The results provided in this review suggest that a work environment that does not give employees the opportunity to control their situation and is also very demanding will lead to ill health and production loss. This is what Karasek and Theorell (1990) suggested as a key factor for creating a healthy workplace in the early 90s. To date, there is limited evidence to show that psychosocial work factors and employee health affect organisational production, because of the limited number of high-quality studies measuring this relationship. The evidence is clearest with regard to job strain and musculoskeletal pain and their effect on production loss. Some of the studies investigated health as a mediating variable between psychosocial work environment factors and organisational production. The question whether health is mediating this relationship or not needs further investigation. We have shown in previous studies that improvements in the psychosocial work environment have an impact on employee health (Lohela et al., 2009) and that psychosocial work factors are both directly and indirectly related to production loss (Lohela Karlsson et al, 2010). There is a need for intervention studies that investigate the effect on production loss, as well as performance, due to improvements in the work environment for the employees. Freeing up resources to improve the work environment is also a financial issue for companies. With growing competition, technological developments and access to good technology, organisational efficiency is essential to remain competitive in a market where knowledge and employees are usually the main assets. Changes in a knowledge-based economy place demands on companies to create healthy organisations with healthy and motivated employees, as their future success is said to be dependent on this (European Network for Workplace Health Promotion, 2005). This work may be facilitated by developing evidence-based methods for organisations.

This review suggests limited evidence for that psychosocial work environment factors and health are predictors of production loss, as indicated by previous research carried out into organisational health and occupational health. More research are needed with longitudinal designs that are adequate for studying the causal relationship between work environment, health and its effect on productivity and workers performance.

5 Conclusions

This review was not able to demonstrate more than limited evidence for the impact of psychosocial work factors and employee health on organisational production, mainly due to the low number of longitudinal studies that have been published. The current evidence points to demand/control at work and musculoskeletal pain as independent predictors of production loss. More high-quality, longitudinal studies are therefore needed. Only then would it be possible to draw strong evidence-based conclusions for a relationship between specific factors in the psychosocial work environment, employee health and organisational outcomes.

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Appendix

Table A 1: Summary of studies reviewed related to production loss

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
Alavania et al., 2009, Netherlands	To evaluate the influence of work-related factors, lifestyle factors and individual characteristics on the association between health problems and productivity loss at work.	Cross-sectional. Questionnaires. Several sectors. Population size = 2,252. Response rate: 56%.	Job demands, job control, skill discretion (Karasek's Job Content questionnaire) Work ability index (WAI) Productivity loss at work (QQ questionnaire)	Lack of job control and work impairment due to health problems increased the odds of productivity loss.	Weak. Less than 60% of the population agreed to participate. Study design is cross-sectional.
D´Souza et al., 2006, Australia	To estimate the magnitude of the association of work demands and perceived insecurity with sickness absence, and to test the health pathways linking work demands and insecurity to sickness absence.	Cross-sectional. Questionnaire. Employees aged 40-44 years in several sectors. Population size: 2,530 (64% of the cohort), sample size 2,248.	Work demands, job control (Karasek's Job Content questionnaire). Physical health (SF-12), depression (Goldberg's scale) Productivity; sickness absence	No relationship between work conditions and short-term absence. Mental and physical health mediated the relationship between work demands and long-term sickness absence.	Moderate
Hagberg et al., 2002, Sweden	To assess whether self-rated reduced productivity at work occurred in computer users due to musculoskeletal symptoms, and to identify associations with workplace and	Cross-sectional. Questionnaire. Private and public organisations, computer users. Population size: 1,532. Response rate 84%.	Work demands, work control, social support, work management Musculoskeletal symptoms Reduced productivity due to musculoskeletal symptoms.	Persistent symptoms were associated with reduced productivity among both men and women. Higher work demands had a higher prevalence ratio for reduced productivity among women.	Weak. Cross-sectional design. The questionnaires were only partly validated. Information about reliability is missing.

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
	individual factors.				
Hagberg et al., 2007, Sweden	To assess the incidence and identify possible risk factors for self-reported reduced productivity owing to musculoskeletal symptoms among computer workers.	Cohort study. Questionnaire. Private and public organisations, computer users. Population size: 1,529. Baseline response rate 84%. Sample size 951. 10 month follow-up.	Work demands, work control, social support, job strain Musculoskeletal symptoms (neck, back, shoulder, forearm/hand problems) Reduced productivity due to musculoskeletal symptoms.	Job demands increased risk of reduced productivity due to neck, back and shoulder problems. Job strain increased the risk of reduced productivity due to forearm/hand and neck problems. Lower control increased the risk of reduced productivity due to forearm/hand problems.	Moderate
Li et al., 2006, Canada	To assess the association between the degree of lost productivity due to arthritis and demographic, disease-related, occupational and psychosocial variables for people.	Cohort study. Questionnaire. Employees with arthritis from rheumatology clinics. Population size: 680. Response rate: 62%.	Job control Health status, type of arthritis, musculoskeletal condition, depression Lost productivity due to arthritis (reduced work hours, lost work days, reduced performance)	Low or medium job control reduced the odds of production loss. Higher depression increased the odds of production loss.	Moderate
Martimo et al., 2009, Finland	To investigate the association between productivity loss and individual characteristics, lifestyle and work-related factors among employees with upper extremity symptoms (UED).	Cross-sectional. Clinical examination and questionnaire. Employees with upper extremity symptoms at medium and large-sized companies. Population size: 177. Response rate 95%.	Job strain: high demands/low control (Karasek's Job Content questionnaire) Pain intensity. Medical diagnoses of different UED. Productivity loss (impact of UED on work performance)	High job strain was only associated with productivity loss among younger subjects. A combination of job strain and pain intensity among younger workers contributed most to productivity loss.	Weak. Cross-sectional design. The questionnaires were only partly validated.

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
Meerding et al., 2005 (country not specified)	To analyse the influence of individual characteristics, work-related risk factors and general health on self-reported productivity at work.	Cross-sectional. Questionnaire. Two samples, construction workers, industrial workers. Population size: 265 & 456. Response rate: 69% & 85%.	Psychosocial load; high job demands, low job control (Karasek´s Job Content). General health (EQ-5D and VAS), mental health, physical health (SF-12), presence of musculoskeletal disorders (Standard Nordic Questionnaire) Productivity loss (HLQ and QQ questionnaire)	Occurrence of musculoskeletal complaints, physical health, mental health and general health was associated with productivity (Both HLQ & QQ). Low-back pain complaints were only associated with QQ and job strain with HLQ.	Weak. Cross-sectional design. No information about confounders.
Musich et al., 2006, Australia	To investigate the impact of selected corporate environment factors, health risks and medical conditions on job performance using self-reported measure of presenteeism.	Cross-sectional. Questionnaire. Service and manufacturing industry, both blue- and white-collar workers. Population size not stated (approx. 8,000). Sample size 1,523.	Work conditions, management/leadership, (AHM HRA questionnaire). Health risks, Perception of health (AHM HRA questionnaire). On-the-job performance; presenteeism (AHM HRA questionnaire)	Work/life imbalance, management/leadership, working conditions, perception of health, and back pain increased the odds of presenteeism.	Weak. Less than 60% of the population agreed to participate. Cross-sectional design.

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
van den Heuvel et al., 2009, Netherlands	To examine the association between pain intensity, various physical and psychosocial factors and productivity loss in computer workers with neck/shoulder and hand/arm symptoms.	Cross-sectional. Questionnaire. Service industry, computer workers. Population size: 9,000. Sample size: 1,951. Response rate: 22%.	Effort & reward (Siegrist's Effort-Reward Imbalance) Pain or discomfort in the neck/shoulder region or in hand/arm region. Productivity loss; reduced productivity at work due to neck/shoulder symptoms or hand/arm symptoms.	Pain intensity and high effort were associated with productivity loss.	Weak. Less than 60% of the population agreed to participate. Cross-sectional design.

Table A 2: Summary of studies reviewed related to performance

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
Bakker et al., 2004 (country not specified)	To investigate how burnout may be related to other ratings of performance.	Cross-sectional. Questionnaires. Several sectors. Populations size = 274. Response rate 53%.	Job demands, job resources (Karasek's job content questionnaire, Van Veldhoven and Meijman) Burnout; exhaustion and disengagement (OLBI) Performance; extra-role and in-role performance (Goodman and Svyantek's scale)	Job demands predicted exhaustion, which explained in-role performance. Job resources predicted extra-role performance, through influences of disengagement.	Weak. Less than 60% percent agreed to participate. Cross-sectional study.
Bakker et al., 2008 (country not specified)	Used the Job Demands-Resources model to examine how job characteristics and burnout contribute to explaining variance in objective team performance.	Cohort study. Questionnaire and data from records. Service industry, white-collar workers. Population size: 508. Response rate 57%. Sample size 176.	Job demands, job resources (Bakker et al. questionnaire) Burnout; emotional exhaustion and cynicism (Maslach Burnout Inventory) Financial performance (data from management information system)	Colleague resources, not supervisor resources, were related to performance. Cynicism mediates the relationship between colleague resources and performance.	Moderate
Byrne & Hochwarter, 2006 (country not specified)	To investigate if perceived organisational support neutralises the effects of chronic pain on performance. If high levels of chronic pain are associated with low	Sample 1: Cross-sectional. Questionnaires. State financial service agency. Population size: 108. Response rate: 93%.	Perceived organisational support (Survey of Perceived Organisational Support, SPOS) Chronic Pain (Chronic Pain Grade Questionnaire)	The interaction between perceived organisational support and pain explained variance in effectiveness and in citizenship behaviour, but not in work intensity. High pain levels were associated with lower performance levels for	Moderate

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
	performance levels when organisational support is perceived as low.		Performance; Perceived effectiveness (Van Dyne, Graham, and Dienesch's scale), work intensity (Brown and Leigh's scale), citizenship behaviour (Smith, Organ, and Near's scale).	those who received low levels of POS.	
		Sample 2: Cross-sectional design. Questionnaires. Blue- and white collar workers. Population size: 375. Response rate: 90%.	Perceived organisational support (Survey of Perceived Organisational Support, SPOS) Chronic Pain (Chronic Pain Grade Questionnaire) Performance; perceived effectiveness (Van Dyne, Graham, and Dienesch's scale), work intensity (Brown and Leigh's scale), citizenship behaviour (Smith, Organ, and Near's scale).	The interaction between perceived organisational support and pain explained variance in all performance measures. High pain levels were associated with lower performance levels for those who received low levels of POS.	Weak. Participants not likely to be representative of the study population. Cross-sectional design.
		Sample 3: Cross-sectional design. Questionnaires. Employees at insurance companies. Population size: 279.	Perceived organisational support (Survey of Perceived Organisational Support, SPOS) Chronic Pain (Chronic Pain	The interaction between perceived organisational support and pain explained variance in task performance. High pain levels were associated with lower	Moderate

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
		Response rate: 62%.	Grade Questionnaire) Supervisor-rated task performance (Wright, Kacmar, McMahan, and Deleeuw's performance measure)	performance levels for those who received low levels of POS.	
Donald et al., 2005, United Kingdom	To assess the relationship between stressors, health and productivity.	Cross-sectional. Questionnaires. Several sectors, blue- and white-collar workers. Population size: 16,001. Response rate? Sample size: 12,846.	Work relationship, work-life balance. overload, control, resources and communication (ASSET) Psychological well-being, physical health (ASSET) Productivity; self-assessed performance (How productive have you felt in your job over the last three months?)	Greater access to resources and information had an indirect effect on productivity through mental well-being.	Weak. Cross-sectional study design. No information about confounders.
Park et al., 2004, United States	To examine how social support at work affects work-stressors, depression, and organisational outcomes.	Cross-sectional. Questionnaire. Service industry, hospital employees. Population size 863. Sample size 240, response rate 28%.	Social support (Eisenberg & Heaney's items for social support). Depression (the Centre for Epidemiological Studies for Depression Scale) Job performance (supervisor-rated performance)	Social support had significant relationships with depression and job performance. High social support was related to low depression and high job performance.	Weak. Less than 60% of the population agreed to participate. Cross-sectional design. No information about confounders.

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
Parker & Kulik, 1995 (country not specified)	To examine if burnout mediates the relationship between job stress, social support and performance indicators.	Cross-sectional. Questionnaire. Hospital employees. Population size: 417. Sample size: 73.	Social support (social support scale by House and Wells) Burnout (Maslach Burnout Inventory). Performance (supervisor-rated and self-rated performance).	Emotional exhaustion mediated the relationship between social support and self-rated performance but not between social support and supervisor-rated performance.	Moderate
Rego & Cunha, 2008 (country not specified)	To see how self-reported individual performance is related to psychological climates and psychological well-being.	Cross-sectional. Questionnaire. Several sectors, white-collar workers. Population size: 213. Response rate 93%.	Spirit of camaraderie, trust and credibility of the leaders, open and frank communication with the leader, opportunities for learning and personal development, work-family conciliation (Questionnaire by Rego and Souto). Affective well-being (instrument developed by Daniel et al.) Performance (self-reported, Staples et al.)	Overall affective well-being mediates the relationship between the spirit of camaraderie, opportunities for learning, personal development and self-reported performance.	Weak. Participants are not likely to be representative of the target population. Cross-sectional design. Has not considered all relevant confounders.

Author, year, country	*Hypotheses/aims*	*Design, data collection, participants, drop-outs, time*	*Investigated factors*	*Results*	*Study quality and relevance , comments*
Taris & Schreurs, 2009, Netherlands	To test the happy-productive worker thesis and see if there is a relationship between the average level of employee well-being in organisations and organisational performance.	Cross-sectional. Questionnaires and data from records. Home care sector employees. Population size: 95 organisations. Sample size: 66 organisations.	Job demands, job control (Karasek's Job Content Questionnaire), social support (Van Veldhoven & Meijman). Emotional exhaustion (Schaufeli & Van Dierendonck) Organisational productivity (Efficiency, client satisfaction, personnel costs and productivity)	Emotional exhaustion was related to client satisfaction, personnel costs and productivity. Demand, control and support did not explain the effect of performance at an organisational level in any more detail.	Moderate

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