Work-related stress risk factors and health outcomes in public sector employees

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ABSTRACT

Introduction: Work-related stress is one of the major concerns for occupational safety and health. Indeed, workplace stress may affect workers' well-being and lead to health issues, and it has been estimated that about half of all work absence is due to work-related stress disorders. The objective of this study is to investigate associations between work-related stress risk factors and a set of health outcomes, in a sample of public sector employees.

Material and methods: Employees (N = 779) filled in a self-report questionnaire on work-related stress, musculoskeletal pain and stressrelated disorders. Logistic regressions were conducted, with pain and disorders as outcome variables and the Health and Safety Executive Management Standards Indicator Tool (HSE-MS IT) scales as predictors.

Results: Excessive workload was associated with neck pain, shoulder pain and anxiety-depression symptoms. Employees exposed to risk on the role dimension reported higher neck pain and more gastrointestinal disorders. Hostile working relationships were associated with shoulder pain and gastrointestinal disorders, and lack of managers' support turned out to be a risk factor for insomnia.

Conclusions: Workplace stress plays a role in the incidence of specific health outcomes. Through the use of validated work-related stress assessment instruments, such as the HSE-MS IT, management can identify the critical intervention targets in work design domains for improving workers' health and well-being.

1. Introduction

Work-related stress is one of the major concerns for occupational safety and health. According to the EU-OSHA 2013 poll, more than half of workers in the European Union report stress as a common issue, and more than forty percent of workers believe that stress is not appropriately handled in their workplace (European Agency for Safety and Health at Work). Several other European surveys indicate that workers frequently report work-related stress as a cause of ill health, with stress and stress-related diseases being second only to musculoskeletal disorders as a cause of health problems in the workplace (Cox et al., 2000a; European Foundation for the Improvement of Living and Working Conditions, 2007; Milczarek et al., 2009). Indeed, evidence has accumulated that uncomfortable working conditions may affect workers' well-being and increase their anxiety-depression symptoms. These include insomnia and health disorders linked to hypothalamic-pituitary-adrenal axis activation, i.e., hypertension, cardiovascular disease, gastritis and peptic ulcer disease, and irritable bowel syndrome (European Foundation for the Improvement of Living and Working Conditions, 2007; Belkic et al., 2004; Eller et al., 2009; Kivimäki et al., 2006). In recent years, increasing attention has been paid to the relationship between stress, musculoskeletal symptoms (Ariëns et al., 2001; Macfarlane et al., 2009; Hartvigsen et al., 2004) and depression of the immune system (Cox et al., 2000a). Stress-related disorders are so common that they are estimated to cause half of all work absences. Work-related stress can also lead to higher rates of accidents, employee turnover and presenteeism. As a result, work-related stress is detrimental to organizational health and productivity as well

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(Cooper et al., 1996; Elkin and Rosch, 1990; Kearns, 1986) and a high priority issue is therefore identifying work-related stress sources and finding effective ways to manage them.

According to the UK Health and Safety Executive (HSE) Management Standards (MS) approach, stress depends on seven work design domains: Demands, Control, Managers' support, Peer support, Relationships, Role, and Change (Cox et al., 2000b; Cousins et al., 2004; Health & Safety Executive, 2007). In agreement with this approach, HSE has developed the Indicator Tool (HSE-MS IT), a questionnaire aimed at assessing each of the seven work-related stress risk factors. Some studies have already demonstrated the psychometric properties of the Indicator Tool, and how each HSE-MS IT scale is sensitive to different work-related stress psychological outcomes, such as job satisfaction, job motivation, and job-related anxiety and depression (Kerr et al., 2009; Bartram et al., 2009; Guidi et al., 2012; Marcatto et al., 2014).

To our knowledge, little is known about the relationships between the HSE Management Standards and health disorders. In fact, most studies have investigated work-related stress and health outcomes by using questionnaires based on two alternative job stress models, the Demand/Control Model (Karasek, 1979) and the Effort-Reward Imbalance Model (Siegrist, 1996), finding, however, different associations and only a small overlap between the two models (Bosma et al., 1998). Therefore, the present study was carried out with the aim of exploring the relationships between the seven HSE-MS IT dimensions and a set of health outcomes that have been associated in literature with stressful situations, in a sample of public sector employees. In accord with the previous findings about the psychological outcomes, we hypothesized that the HSE-MS IT scales are also sensitive to different work-related health outcomes, that is, we expected high risk levels in different work design domains to be specifically associated with different health conditions.

2. Methods

2.1. Participants and procedure

The participants were employees working in different sectors (civil registry, local police, market surveillance, culture and sport, education and social services) in a municipality in Italy. We applied a non-proportional stratified random sampling, and our resulting eligible sample for the present study was of 779 employees out of a population of 1681 public workers, with a sampling rate of 20% from local police and of 50% from other sectors. Participants were recruited at the beginning of a refresher course about safety. They were informed that this study was part of the mandatory work-related stress assessment required by the Italian law, it was approved by their trade unions, and that all measurement instruments were anonymous and only aggregated data would be fed back to the municipality. In all, 760 valid questionnaires were collected (97.6%). The majority of respondents were female (78%) and had a permanent job contract (83%). The age distribution was as follows: 3% were 18–29 years old, 16% were 30–39 years old, 40% were 40–49 years old, 38% were 50–59 years old, and 3% were older than 59.

2.2. Measures

Participants were asked to fill out two questionnaires, anonymously, in a self-report format: (i) the Italian version of the HSE-MS Indicator Tool (Marcatto et al., 2011), (ii) a questionnaire that measured musculoskeletal pain and assessed the presence of other disorders that have been associated with exposure to stressful situations. Participants were asked to provide some basic demographic information as well, useful to describe the sample. The questionnaire also included other psychosocial variables, which we analyzed in a previous paper (Marcatto et al., 2014).

The HSE-MS Indicator Tool is a 35-item questionnaire aimed at assessing psychosocial variables relevant to evaluating exposure to stress factors, according to the Management Standards developed in the United Kingdom by the Health and Safety Executive (MacKay et al., 2004). HSE-MS IT takes into account a six-month time window prior to measurement and is composed of seven scales: Demands (8 items), Control (6 items), Managers' support (5 items), Peer support (4 items), Relationships (4 items), Role (5 items), and Change (3 items). Higher scores on the HSE-MS IT scales indicate a lower stress risk. For the present sample, Cronbach's Alphas for the seven scales ranged from 0.66 (Control) to 0.89 (Peer support), and they were comparable to alpha values observed in previous studies (Marcatto et al., 2011).

The self-report health assessment questionnaire was divided into three sections. In the first section, participants were asked to report musculoskeletal pain experienced in the last month in four areas of the body (neck, shoulders, upper back, and lower back) using the 11-point Numeric Pain Rating Scale (0 = no pain, 10 = severe pain; McCaffery and Pasero, 1999).

In the second section, participants were asked whether they suffered from hypertension, insomnia, anxiety-depression symptoms, and gastrointestinal disorders (yes/no). This kind of self-report anamnestic questionnaire is widely used in the literature.

Finally, participants were asked for their weight and height for Body Mass Index (BMI) calculation.

2.3. Data analysis

Mean scores and standard deviations were first calculated for each of the seven HSE-MS IT scales, and compared with Italian benchmark data (Rondinone et al., 2012). Descriptive statistics were also provided regarding workers' health assessment. Next, in order to assess associations between HSE-MS IT scales, musculoskeletal pain, and other health outcomes, we conducted hierarchical logistic regressions; with pain and health complaints as outcome variables and the HSE-MS IT scales as predictors, after controlling for gender, age group, and BMI. We dichotomized pain scores so as to distinguish between employees who referred zero to moderate pain levels (0–6 recoded into 0) from those who referred severe pain levels (7–10 recoded into 1), as is usually done with the Numeric Pain Rating Scale (McCaffery and Pasero, 1999). As to HSE-MS IT, we dichotomized scores in accordance with benchmark data: Scores below the 20th percentile reflect a high stress risk and were coded as 1, the remaining scores were coded as 0. This way, Odds Ratio (OR) and their respective 95% Confidence Intervals (95% CI) were observed for pain, health outcomes and job factors, adjusting for the effects of gender, age, and BMI.

3. Results

Table 1 presents descriptive statistics observed for the HSE-MS IT scales in our sample. Compared to the Italian benchmark data, the average scores were above the 50th percentile for the peer support scale only (with a result labeled as "*Good, but need for improvement*"), while all other scales were between the 20th and the 50th percentile (with a result labeled as "*Clear need for improvement*").

Musculoskeletal pain assessment and disorder incidence are reported in Tables 2 and 3, respectively. Average pain scores were lower than the mid-point of the numeric rating scale, with the lower back area being the more painful area (M = 4.63, DS = 3.22), with 27.4 per cent of employees reporting high pain

Table 1
Average scores on measures of interest. Higher scores in the HSE-MS IT scales mean lower risk.

	Mean + SD	Benchmark comparison
HSE-MS IT Demands	3.33 ± 0.63	<50th percentile
HSE-MS IT Control	3.37 ± 0.68	<50th percentile
HSE-MS IT Managers' support	3.35 ± 1.01	<50th percentile
HSE-MS IT Peer support	3.95 ± 0.77	<80th percentile
HSE-MS IT Relationships	3.87 ± 0.77	<50th percentile
HSE-MS IT Role	4.26 ± 0.63	<50th percentile
HSE-MS IT Change	3.30 ± 0.92	<50th percentile

Table 2
Average scores on musculoskeletal pain scales. Scales ranged from 0 to 10, scores in the 7–10 range were coded as high pain.

	Mean + SD	High pain (%)
Neck	3.92 ± 3.01	19
Shoulders	4.07 ± 3.20	22
Upper back	3.45 ± 3.17	15
Lower back	4.63 ± 3.22	27

The cut-off score of 7 corresponds to the 80th percentile for neck, shoulders and upper back pain, and to the 70th percentile for lower back pain.

levels, with the upper back area less painful (M = 3.45, DS = 3.17), with 15.3 per cent of participants referring high pain. Gastrointestinal disorders, such as gastritis, colitis, and gastro-esophageal reflux were the most prevalent health complaints, affecting almost one-third of the workers (Table 3). Insomnia and anxiety-depression symptoms were also quite frequent, being reported by about one-fifth of the workers.

The results presented in Table 4 shows that gender is significantly associated with musculoskeletal pain in all the considered areas: female workers were 2.65–4.80 times more at risk of suffering from musculoskeletal pain compared to their male colleagues. No significant associations were found between musculoskeletal pain, age, and BMI.

Table 3
Incidence of health complaints.

	NO (%)	YES (%)
Hypertension	614 (86.2)	98 (13.8)
Insomnia	570 (79.3)	149 (20.7)
Anxiety-depression symptoms	570 (80.2)	141 (19.8)
Gastrointestinal disorders	492 (68.5)	226 (31.5)

Table 4 also reports odd ratio values between musculoskeletal pain and psychosocial workplace risk factors, controlling for age, gender, and BMI. Specific associations emerged between neck pain, shoulder pain and stress risk factors. Workers exposed to high risk in the Demands dimension were more at risk of suffering from neck pain (1.78 times) and shoulder pain (2.03 times) when compared to colleagues who reported low scores on the Demands scale. High risk in the Role domain was associated with neck pain (1.82 times higher), and high risk in the Relationships dimension was associated with shoulder pain (2.05 times higher). In this analysis, no associations emerged between workplace risk factors and back pain (upper or lower).

In order to increase the statistical power of our findings, we conducted additional backward logistic regression analyses. This is an iterative procedure; at each step the least significant predictor is removed and the model refitted, until all remaining predictors are significant ($p < 0.05$). These additional analyses confirmed all the significant associations that emerged in the previous analysis, and showed other significant associations between the Demands scale and upper back pain (OR = 1.92, 95% CI 1.06–3.50, $p < 0.05$), the Control scale and lower back pain (OR = 1.81, 95% CI 1.02–3.22, $p < 0.05$), the Peer Support dimension and both shoulder pain (OR = 2.13, 95% CI 1.04–4.35, $p < 0.05$) and lower back pain (OR = 2.50, 95% CI 1.35–4.64, $p < 0.01$), and finally between the Relationships dimension and upper back pain (OR = 2.11, 95% CI 1.06–4.20, $p < 0.05$). Moreover, a last set of logistic regression analyses were conducted in order to investigate potential interaction effects between the significant predictors, and between the Demand and Control scales, the two critical dimensions in the well-known Demand/Control Model of job stress (Karasek, 1979). No significant interactions emerged from these analyses.

Table 5 shows how the HSE-MS IT domains were related to age, gender, and health disorders. As expected, age turned out to be a significant risk factor for hypertension and insomnia, with employees 50 years or older more at risk of these disorders (2.97 and 2.20 times, respectively) in comparison with their younger colleagues. Gender was only significantly associated with gastrointestinal disorders: compared to males, women were 1.88 times more at risk of suffering from gastritis, colitis, and gastro-esophageal reflux.

BMI was found to be a strong risk factor for hypertension: overweight workers were almost four times more likely to suffer from hypertension than their colleagues. Workplace stress dimensions, after controlling for age, sex, and BMI, were associated with physical and psychological problems: High risk in the Managers' support dimension was found to increase the risk of insomnia (1.83 times), high risk in the Demands dimension doubled the risk of anxiety-depression symptoms, and strong problems in the

Table 4
Psychosocial workplace risk factors and musculoskeletal pain.

Predictors	Neck pain OR (95% CI)	Shoulder pain OR (95% CI)	Upper back pain OR (95% CI)	Lower back pain OR (95% CI)
Age (⩾50)	0.92 (0.53–1.58)	1.32 (0.78–2.21)	1.34 (0.75–2.42)	0.88 (0.55–1.42)
Gender (female)	3.16** (1.49–6.72)	4.80*** (2.22–10.34)	3.24** (1.38–7.62)	2.65*** (1.46–4.81)
BMI (⩾25)	0.65 (0.35–1.18)	1.26 (0.72–2.18)	0.92 (0.49–1.72)	1.34 (0.82–2.19)
Demands	1.78* (1.01–3.15)	2.03* (1.15–3.58)	1.79 (0.94–3.40)	1.37 (0.80–2.35)
Control	1.32 (0.67–2.60)	0.72 (0.36–1.47)	2.02 (0.96–4.25)	1.57 (0.86–2.88)
Managers' support	0.36 (0.35–1.30)	1.21 (0.66–2.22)	0.70 (0.34–1.44)	1.28 (0.73–2.32)
Peer support	1.54 (0.70–3.38)	1.99 (0.93–4.24)	1.41 (0.59–3.40)	1.95 (0.98–3.89)
Relationships	1.42 (0.69–2.92)	2.05* (1.03–4.08)	1.92 (0.85–4.35)	1.44 (0.74–2.82)
Role	1.82* (1.02–3.25)	1.51 (0.85–2.67)	1.25 (0.65–2.41)	0.76 (0.44–1.32)
Change	1.45 (0.79–2.65)	1.29 (0.71–2.34)	0.76 (0.38–1.55)	1.16 (0.67–2.02)

OR, odds ratio; 95% CI, 95% confidence interval.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 5
Psychosocial workplace risk factors and health complaints.

Predictors	Hypertension OR (95% CI)	Insomnia OR (95% CI)	Anxiety-depression OR (95% CI)	Gastrointestinal disorders OR (95% CI)
Age (⩾50)	2.97[***] (1.65–5.37)	2.20[**] (1.33–3.63)	1.16 (0.69–1.96)	1.15 (0.72–1.81)
Gender (female)	1.20 (0.61–2.37)	1.11 (0.61–2.00)	1.07 (0.58–1.96)	1.88[*] (1.07–3.32)
BMI (⩾25)	3.97[***] (2.19–7.22)	0.99 (0.58–1.69)	1.12 (0.65–1.93)	1.57 (0.98–2.54)
Demands	1.35 (0.66–2.76)	1.44 (0.82–2.52)	2.16[**] (1.23–3.78)	1.51 (0.90–2.54)
Control	0.41 (0.14–1.16)	1.42 (0.74–2.74)	1.15 (0.58–2.31)	1.84 (0.99–3.43)
Managers' support	0.85 (0.42–1.73)	1.83[*] (1.02–3.26)	1.08 (0.58–1.99)	1.13 (0.66–1.94)
Peer support	1.20 (0.46–3.11)	1.38 (0.68–2.80)	1.45 (0.69–3.05)	0.61 (0.30–1.28)
Relationships	1.35 (0.52–3.48)	1.35 (0.67–2.70)	1.03 (0.49–2.19)	2.88[**] (1.51–5.51)
Role	0.80 (0.40–1.60)	1.19 (0.68–2.07)	1.60 (0.91–2.84)	1.92[*] (1.18–3.17)
Change	1.31 (0.63–2.72)	1.01 (0.56–1.82)	0.90 (0.48–1.68)	0.66 (0.37–1.15)

OR, odds ratio; 95% CI, 95% confidence interval.
[*] $p < 0.05$.
[**] $p < 0.01$.
[***] $p < 0.001$.

Relationships and Role domains were related to higher risk of suffering from gastrointestinal disorders (2.88 and 1.92 times, respectively). No significant associations emerged between hypertension and workplace stress dimensions. As we already did for musculoskeletal pain, we conducted two additional sets of logistic regressions, which confirmed all the significant associations, and did not find other significant associations or significant interactions.

4. Discussion

It is well known that psychosocial problems at work are strongly related to health complaints, however only a few studies have investigated whether different subcomponents of the broad multidimensional construct called work-related stress can predict specific physical and psychological problems. To this purpose, we used the HSE-MS Indicator Tool, because it assesses stress risk in seven relatively independent workplace domains rather than yielding a general stress score (Cousins et al., 2004).

Several associations emerged between the HSE-MS workplace stress dimensions, musculoskeletal pain, and physical and psychological complaints. Results suggested that the Demands domain has a relevant impact on individual physical and psychological well-being. In fact, critical levels on this domain significantly increased risk of suffering from pain in the neck, shoulder areas and upper back, as well as from anxious and depressive symptoms. Risk in the Demands dimension indicates excessive workload and work pace, such as having too many things to do in too little time - thus the association with musculoskeletal pain and anxiety and depression is not surprising, and coherent with existent literature (Ariëns et al., 2001; Faragher et al., 2005; Clays et al., 2007; Dragano et al., 2008). Other relevant dimensions were Relationships and Role, both associated with gastrointestinal disorders, and with pain in the shoulder and upper back and pain in the neck area respectively. Lack of Support from the management turned out to increase the risk of insomnia, while lack of Support from colleagues was associated with musculoskeletal pain in the shoulder and lower back. Lastly, low Control conditions increased the risk of suffering from lower back pain.

Overall, the results of this study are consistent with the biopsychosocial model of pain and illness, in which health and illness are being viewed as the complex interaction of biological, psychological and social factors, including social support and work climate (Drossman et al., 1999; Suls and Rothman, 2004; Gatchel et al., 2007).

It is worth noting that the Change dimension showed no significant associations with musculoskeletal pain and health disorders, and another relevant dimension, Control, was associated only with lower back pain. Specifically, the Control domain is expected to play a key role according to Karasek's Demand/Control Model (Karasek, 1979). Our results, however, are in agreement with previous studies that already challenged the relevance of this domain, by showing that Control does not always represent a risk factor for diseases and for the perception of stress (Eller et al., 2009; Marcatto et al., 2014). Moreover, lack of control (defined as "limited opportunity to manage own work patterns") turned out to be the least perceived cause of work-related stress by workers in the EU-OSHA 2013 survey European Agency for Safety and Health at Work - coming well after factors like workload, unacceptable behaviors (such as bullying or harassment), lack of support from colleagues or superiors, and lack of clarity on roles and responsibilities.

There are some limitations of the present study that have to be acknowledged. First, this is a cross-sectional study and it therefore describes associations between variables, but not causal or across-time relationships - that is, we cannot say anything on the direction of the relationship between physical and psychological complaints and stress conditions at work. Second, our findings are based on self-reports. These are very widely adopted in research because they are less invasive and less expensive in terms of money and time. However, self-reports may well assess subjective health conditions, but can provide data which are less objective as compared to information obtained via medical files or examination.

5. Conclusions

The results of this study strengthen the idea that specific workplace stress factors can play a role in the incidence of physical and psychological disorders. Specifically, excessive workload and high levels of time pressure, conflicting roles, and poor social support (in terms of both social relationships and support from the management and from colleagues) emerged as risk factors which could amplify pain perception and increase the odds of suffering from physical and psychological pathologies.

The findings support a multi-dimensional approach for assessing work stress, because it helps predict stress-related disorders that are more likely to affect employees by identifying critical psychosocial work design dimensions that need improvement. Along with occupational psychologists, occupational physicians can therefore use work-related stress assessment results to enhance medical surveillance and to plan interventions aimed at improving content and context work factors. For example, after the present study's results have been fed back to the municipality, the management decided to undertake a project in order to tackle the sources

of stress. Specifically, employees have been actively involved in a change process, which included the reorganization of jobs and tasks, increased assistance and support from managers, and interventions aimed at reducing workplace conflicts. Moreover, special attention has been given to female employees, who were found to be more at risk of suffering from health disorders and pain.

Setting up appropriate management strategies for preventing and tackling risks arising from work-related stress can provide benefits for employees' health and well-being, and also brings benefits for organizations, reducing absenteeism, clinic visits and staff turnover.

References

Ariëns, G.A., van Mechelen, W., Bongers, P.M., Bouter, L.M., van der Wal, G., 2001. Psychosocial risk factors for neck pain: a systematic review. Am. J. Ind. Med. 39, 180–193.

Bartram, D.J., Yadegarfar, G., Baldwin, D.S., 2009. Psychosocial working conditions and work-related stressors among UK veterinary surgeons. Occup. Med. (Lond.) 59, 334–341.

Belkic, K.L., Landsbergis, P.A., Schnall, P.L., Baker, D., 2004. Is job strain a major source of cardiovascular disease risk? Scand. J. Work Environ. Health 30, 85–128.

Bosma, H., Peter, R., Siegrist, J., Marmot, M., 1998. Two alternative job stress models and the risk of coronary heart disease. Am. J. Public Health 88, 68–74.

Clays, E., Bacquer, D.D., Leynen, F., Kornitzer, M., Kittel, F., De Backer, G., 2007. Job stress and depression symptoms in middle-aged workers — prospective results from the Belstress study. Scand. J. Work Environ. Health 33, 252–259.

Cooper, C.L., Liukkonen, P., Cartwright, S., 1996. Stress Prevention in the Workplace: Assessing the Costs and Benefits to Organisations. European Foundation for the Improvement of Living and Working Conditions, Dublin.

Cousins, R., MacKay, C.J., Clarke, S.D., Kelly, C., Kelly, P.J., McCaig, R.H., 2004. 'Management standards' and work related stress in the UK: practical development. Work Stress 18, 113–136.

Cox, T., Griffiths, A., Rial-González, E., 2000a. Research on Work-Related Stress. Office for Official Publications of the European Communities, Luxembourg.

Cox, T., Griffiths, A., Barlow, C., Randall, R., Rial-Gonzalez, E., 2000b. Organisational Interventions for Work Stress: A Risk Management Approach. HSE Books, Sudbury.

Dragano, N., He, Y., Moebus, S., Jöckel, K.H., Erbel, R., Siegrist, J., 2008. Two models of job stress and depressive symptoms. Results from a population-based study. Soc. Psychiatry Psychiatr. Epidemiol. 43, 72–78.

Drossman, D.A., Creed, F.H., Olden, K.W., Svedlund, J., Toner, B.B., Whitehead, W.E., 1999. Psychosocial aspects of the functional gastrointestinal disorders. Gut 45 (Suppl II), II25–II30.

Elkin, A.J., Rosch, P.J., 1990. Promoting mental health at the workplace: the prevention side of stress management. Occup. Med. (Lond.) 5, 739–754.

Eller, N.H., Netterstrøm, B., Gyntelberg, F., Kristensen, T.S., Nielsen, F., Steptoe, A., et al., 2009. Work-related psychosocial factors and the development of ischemic heart disease: a systematic review. Cardiol. Rev. 17, 83–97.

European Agency for Safety and Health at Work. European Opinion Poll on Occupational Safety and Health. <https://osha.europa.eu/en/safety-health-in-figures/eu-poll-press-kit-2013.pdf> (accessed 10.07.14).

European Foundation for the Improvement of Living and Working Conditions, 2007. Fourth European Working Conditions Survey. Office for Official Publications of the European Communities, Luxembourg.

Faragher, E.B., Cass, M., Cooper, C.L., 2005. The relationship between job satisfaction and health: a meta-analysis. Occup. Environ. Med. 62, 105–112.

Gatchel, R.J., Bo Peng, Y., Peters, M.L., Fuchs, P.N., Turk, D.C., 2007. The biopsychosocial approach to chronic pain: scientific advances and future directions. Psychol. Bull. 133, 581–624.

Guidi, S., Bagnara, S., Fichera, G.P., 2012. The HSE indicator tool, psychological distress and work ability. Occup. Med. (Lond.) 62, 203–209.

Hartvigsen, J., Lings, S., Leboeuf-Yde, C., Bakketeig, L., 2004. Psychosocial factors at work in relation to low back pain and consequences of low back pain; a systematic, critical review of prospective cohort studies. Occup. Environ. Med. 61, e2.

Health & Safety Executive, 2007. Managing the Causes of Work-Related Stress. A Step-by-Step Approach Using the Management Standards, second ed. HSE Books, Sudbury.

Karasek, R.A., 1979. Job demands, job decision latitude, and mental strain: implications for job design. Admin. Sci. Quart. 24, 285–308.

Kearns, J., 1986. Stress at Work: The Challenge of Change. BUPA, London.

Kerr, R., McHugh, M., McCrory, M., 2009. HSE management standards and stress-related work outcomes. Occup. Med. (Lond.) 59, 574–579.

Kivimäki, M., Virtanen, M., Elovainio, M., Kouvonen, A., Väänänen, A., Vahtera, J., 2006. Work stress in the etiology of coronary heart disease—a meta-analysis. Scand. J. Work Environ. Health 32, 431–442.

Macfarlane, G.J., Pallewatte, N., Paudyal, P., Blyth, F.M., Coggon, D., Crombez, G., et al., 2009. Evaluation of work-related psychosocial factors and regional musculoskeletal pain: results from a EULAR Task Force. Ann. Rheum. Dis. 68, 885–891.

MacKay, C.J., Cousins, R., Kelly, P.J., Lee, S., McCaig, R.H., 2004. 'Management Standards' and work-related stress in the UK: Policy background and science. Work Stress 18, 91–112.

Marcatto, F., D'Errico, G., Di Blas, L., Ferrante, D., 2011. Assessing work-related stress: an Italian adaptation of the HSE management standards work-related stress indicator tool. Ital. J. Occup. Med. Ergon. 33, 403–408.

Marcatto, F., Colautti, L., Larese Filon, F., Luis, O., Ferrante, D., 2014. The HSE Management Standards Indicator Tool: concurrent and construct validity. Occup. Med. (Lond.) 64, 365–371.

McCaffery, M., Pasero, C., 1999. Pain: Clinical Manual, second ed. Mosby, St. Louis.

Milczarek, M., Schneider, E., Rial-González, E., 2009. OSH in Figures: Stress at Work — Facts and Figure. Office for Official Publications of the European Communities, Luxembourg.

Rondinone, B.M., Persechino, B., Castaldi, T., Valenti, A., Ferrante, P., Ronchetti, M., et al., 2012. Work-related stress risk assessment in Italy: the validation study of Health Safety and Executive indicator tool. Ital. J. Occup. Med. Ergon. 34, 392–399.

Siegrist, J., 1996. Adverse health effects of high-effort/low-reward conditions. J. Occup. Health Psychol. 1, 27–41.

Suls, J., Rothman, A., 2004. Evolution of the biopsychosocial model: prospects and challenges for health psychology. Health Psychol. 23, 119–125.