

Johannes Siegrist

Chronic psychosocial stress at work and risk of depression: evidence from prospective studies

■ **Abstract** Due to their high prevalence and severe consequences depressive disorders provide a primary challenge to medicine and public health. Improving our understanding of modifiable risk factors may help to advance preventive efforts. Chronic psychosocial stress at work, as defined by two theoretical models, demand-control and effort-reward imbalance, is one such modifiable risk factor. This paper reviews and discusses current evidence of associations between work-related psychosocial stress and depression based on a systematic review of prospective cohort studies of these two models, published within the last 10 years. Findings from 12 reports indicate a rather consistently elevated odds ratio of about 1.8 of depression among men and women who were exposed to high demand and low control at work or who spent high efforts in combination with low rewards received in turn. Findings are substantiated by results from experimental investigations that explored psychobiological mechanisms underlying this association. In conclusion, there is solid evidence of a prospectively established moderate association of chronic psychosocial stress at work, as defined by theoretical models, with depression. Despite open research questions the implications of these findings for prevention should be addressed.

■ **Key words** work stress · depression · demand-control · effort-reward imbalance

Introduction

The multifactorial origins of affective disorders have been convincingly demonstrated [4]. These disorders continue to generate a high burden of disease and related costs across the world [19]. From a public health perspective, identifying modifiable risk factors may help to design and implement preventive measures in order to reduce this burden. During the past 15 years considerable progress was achieved in defining and quantifying one such risk factor, chronic psychosocial stress at work. This progress was largely due to the development of theory-based measurements of stressful aspects of a psychosocial work environment that were applied to working populations in prospective and cross-sectional epidemiological investigations. Two such measurements received special attention in international research: the job content questionnaire measuring the demand-control model [13] and a standardized questionnaire measuring the effort-reward imbalance model [30].

The focus of the former model is on a specific combination of job task characteristics, i.e., high quantitative psychological demands and a low degree of control over one's tasks, a combination that prevents the experience of autonomy of the working person [14]. Low control at work is defined in terms of low decision latitude and low level of skill discretion. In a more recent conceptualisation, social support at work has been added to this model where lack of support aggravates stressful experience whereas its presence buffers health-adverse effects [12].

The effort-reward imbalance model is concerned with the reciprocity of a contractual exchange at work where efforts are compensated by adequate rewards in terms of money, career opportunity including job security and esteem. Both extrinsic (demands) and intrinsic (overcommitment) factors contribute to high efforts spent. Lack of reciprocity between (high) efforts and (low) rewards is relatively frequent in modern economy and may elicit strong stress reactions due to the fact that a basic principle of social

Prof. Dr. J. Siegrist (✉)
Director, Dept. of Medical Sociology, Faculty of Medicine
Heinrich-Heine-University of Duesseldorf
Universitätsstr. 1
40225 Düsseldorf, Germany
Tel.: +49-211-8114360
Fax: +49-211-8112390
E-Mail: Siegrist@uni-duesseldorf.de

exchange is violated [29]. Although the exact mechanisms linking the experience of chronic psychosocial stress at work with the development and onset of depressive disorders have not yet been elucidated this association has been established in several large prospective epidemiological investigations (see 'Results'), and has been further substantiated by cross-sectional and experimental studies (see 'Discussion'). In this paper, recent evidence from prospective cohort studies based on one or both work stress models in association with depression is briefly reviewed, and its scientific significance is discussed.

Methods

A summary of results from prospective epidemiological investigations estimating elevated risks of depression as a function of exposure to psychosocial stress at work is given. To this aim, a systematic review of prospective cohort studies using one or both of these work stress models in relation to depression was conducted. The search strategy was limited to original research papers published in peer-reviewed journals in English language between January 1998 and April 2008. At least 1 year of exposure was required, and special attention was put on assessed mental health status of participants at study on set (exclusion of baseline depression where respective data were available). Medline and additional data sources as well as references from published studies were used to identify relevant publications. Search terms were 'demand-control (model)' or 'job strain (model)' and 'depression' or 'depressive symptoms' or 'affective disorder'; or 'effort-reward imbalance (model)' and 'depression' or 'depressive symptoms' or 'affective disorder'; 'cohort (study)' or 'longitudinal /study)' or 'prospective (study)'; 'odds ratio' or 'relative risk'. Fifteen publications were identified, and five had to be excluded because they did not provide a valid measure of depression or did

not report relative risks or odds ratios. The 10 publications contain findings from 12 prospective observational epidemiological investigations.

Studies vary with respect to the measurement of work-related stress because in some investigations the original scales were not available, but were replaced by proxy measures. Moreover, studies vary with regard to the assessment of depression which, in some investigations, was based on doctor-diagnosed information, but in a majority of cases was measured by psychometrically validated scales, such as the CES-D scale [26], the GHQ [8], or the SCL-90 [5]. For these reasons, the comparability of findings is restricted.

The original measurement of the demand-control model is based on two scales measuring demands (eight items) and control (eight items). The dimension of control is further subdivided into two scales: 'skill discretion' and 'decision authority'. In some studies, the scale 'social support at work' is additionally measured. In addition to their separate analysis the two main scales of the demand-control model are usually combined to test the impact of the critical combination 'high demand and low control' (or 'job strain') [13]. The original measurement of the effort-reward imbalance model contains three scales, 'effort' (6 Likert-scaled items), 'reward' (11 items measuring the subcomponents 'financial reward', 'esteem' and 'job security'), and 'overcommitment' (6 items measuring the motivational component of spending effort). For theoretical reasons, the ratio of effort and reward is of critical importance in estimating adverse health effects [30].

To test associations of an adverse psychosocial work environment with risk of incident depressive disorder multivariate logistic regressions were calculated with components of the work stress models as predicting variables and depression as binary outcome variable, adjusting for relevant confounders. Odds ratios are given in the respective tables and statistical significance is estimated based on the respective 95% confidence intervals.

Results

In Table 1, results from twelve reports of prospective observational epidemiological investigations are

Table 1 Overview of results from prospective studies on associations of chronic psychosocial stress at work (demand-control; effort-reward imbalance) and depression

First author (year)	Sample (n, men and women)	Outcome	Odds ratio, 95% CI
Job demand-control model			
Niedhammer [22]	11,552	Depressive symptoms ^a	DC: m 1.4 (1.2–1.6) w 1.4 (1.2–1.7) ^f
Stansfeld [33]	10,308	Depressive symptoms ^b	DC: m 1.4 (1.2–1.6) w 1.2 (1.0–1.5)
Shields [31]	3,380	Major depressive episode ^c	DC: m 3.3 (1.3–8.4) w 2.1 (1.1–4.0)
Wang [38]	7,371	Physicians' diagnosis (CIDI) ^c	D: 1.3 (1.1–1.6) C: 1.2 (1.0–1.5) ^g
Marchand [18]	7,311	Physicians' diagnosis (CIDI) ^c	D: 1.0 (0.9–1.1) C: 1.1 (1.0–1.1) ^h
Ylipaavalniemi [41]	4,815	Physicians' diagnosis	DC: 1.2 (0.9–1.6)
Rugulies [27]	4,133	Depressive symptoms ^d	D: m 0.5 (0.2–1.2) w 1.0 (0.5–1.7) C: m 0.6 (0.3–1.2) w 1.9 (1.1–3.4)
Ahola [1]	2,555	Depressive symptoms ^a	DC: 3.4 (2.0–5.7)
Effort-reward imbalance model			
Stansfeld [33]	10,308	Depressive symptoms ^b	ERI: m 3.6 (2.8–4.8) w 1.9 (1.2–2.9) ⁱ
Godin [7]	1,986	Depressive symptoms ^e	ERI: m 2.8 (1.3–5.7) w 4.6 (2.3–9.0)
Kivimäki [16]	47,351	Physicians' diagnosis	ERI: 1.5 (1.2–1.8)
Kivimäki [16]	21,938	Physicians' diagnosis	ERI: 1.6 (0.9–2.7)

^aCES-D [26]

^bGHQ [8]

^cCIDI [15]

^dMHI-5 [2]

^eSCL-90 [5]

^fDemand-Control ('Job strain')

^gSkill discretion only

^hDecision authority only

ⁱERI combined measure of high effort and low reward

summarized. Eight reports concern the demand-control model, and four reports test the effort-reward imbalance model. One study explores the two models simultaneously within the same study design [33], and one publication reports the results from two separate investigations [16]. All studies included male and female working populations, and effects are given separately according to gender where available.

Occupational groups include civil servants, white collars and blue-collars from production and service sectors, both private and public, and a group of self-employed professionals. Participants are from the United Kingdom, France, Finland, Belgium and Canada. The duration of observation varies between 1 and 7 years, and depression is assessed either by validated questionnaires or physicians' diagnosis. In some studies, combined measures of high demand and low control ('job strain') are given, in other studies, effects of single components are calculated. With regard to the effort-reward imbalance model, a summary measure combining high effort and low reward is always given. Odds ratios together with the 95 per cent confidence intervals are indicated.

Table 1 demonstrates that in a majority of cases, 'high demand and low control' ('job strain') (or single components) and 'high effort in combination with low reward' are associated with moderately elevated risks of depression although some inconsistency is obvious. There is a tendency towards stronger effects of the combined 'job strain' effect versus effects of single components although no evidence of a multiplicative interaction term of the two components is available. Effects of the single component 'demand' are weaker than those of 'control'. However, in some studies, control is further divided into the subcomponents 'skill discretion' and 'decision authority', and again, effects are not consistent.

In contrast, effects of effort-reward imbalance on depression are more consistent and generally somewhat stronger although the number of studies is still limited. Effects of additional components of the two models are not specified in Table 1 due to the low number of respective studies. It should be noticed, however, that low support at work was modestly related to the risk of depression [22, 33, 39, 41] and that job insecurity, a component of the effort-reward imbalance model, was separately related to depression in two studies [27, 39].

Discussion

This contribution demonstrates that chronic psychosocial stress at work, as measured by the demand-control and the effort-reward imbalance models, is associated with significantly elevated risks of depression in 16 out of 22 tests within twelve reports of results from prospective epidemiological investigations. Results cover an extended middle-aged popu-

lation of working men and women from a variety of occupations and countries. The strength of association, as indicated by a positive odds ratio with significant 95 per cent confidence intervals, varies from study to study, but overall points to a moderate association (a summary estimate of about 1.8; [34]). In other words, working in a job with high demand and low control or being engaged in effortful work that provides low rewards in terms of money, esteem, promotion prospects and job security increases the risk of incident depression by about eighty per cent within a few years.

Additional prospective and cross-sectional studies not reported here support this finding [6, 20, 23, 25, 34, 36]. Importantly, in several studies depression was assessed by established psychiatric interviews that add to the validity of reported results [18, 20, 31, 39]. Some studies analysed effects on depression produced by a simultaneous exposure to the stressful working conditions defined by the two models [6, 23, 25, 33, 36]. This approach is of interest as the models identify complementary aspects of a stressful work environment and, thus, offer the opportunity to evaluate the relative strength of each association. Moreover, being simultaneously exposed to multiple stressors may increase the risk of depression in an additive or even synergistic way. This latter aspect was examined in a recent cross-sectional study that documented highest odds ratios for those who were simultaneously exposed to low control and effort-reward imbalance (odds ratio: 4.1) and those with low control and high scores on a scale measuring work-related overcommitment (the intrinsic component of the effort-reward imbalance model) (odds ratio: 5.4; synergy index: 2.1) [6].

The two models analysed here do not cover the whole range of a health adverse psychosocial work environment. For instance, a further component of a stressful work environment, organisational injustice, was shown to be related to elevated risk of depression [16]. The same holds true for stressful experience related to work-home interference [39]. A recent review documented elevated risks of depressive symptoms among employees characterised by underemployment and those exhibiting 'presenteeism' (that is, a tendency to work while being sick) [28]. Thus, it is likely that the reported effects of chronic stress at work underestimate the full potential of psychosocial adversity at work as related to mental health. Moreover, there may be specifically vulnerable subgroups with elevated risks of disease. Low socio-economic status is one such condition of vulnerability. A recent study documented an additive effect of effort-reward imbalance at work and low socio-economic position on depression, with a significant synergy index. The probability of exhibiting a critically elevated level of depressive symptoms was seven times as high among men and women with lowest socio-economic position who suffered from effort-

reward imbalance compared to those with highest socio-economic status and who were free from stress at work [40]. It is of interest to notice that the two work stress models have recently been extended beyond work, to explain elevated risk of depression at home [9] and in voluntary work or other socially productive activities [37].

Although these additional findings support the general conclusion of health-adverse effects of stressful work relatively little is known about psychobiological mechanisms linking adversity at work with the development of depressive disorder. Chronic stress was shown to alter the hypothalamic-pituitary-adrenocortical axis, and dysregulation of this axis is implicated in the development of affective disorder [21]. An altered diurnal pattern of cortisol secretion was documented in men with high level of effort-reward imbalance at work [11] and in men scoring high on the scale measuring overcommitment at work [35]. Chronic inflammation may be an additional marker of psychobiological imbalance with relevance to affective and cardiovascular or metabolic disorder [34]. Again, psychosocial stress at work was associated with elevated level of inflammation in independent reports [3, 10].

At a methodological level, a critical limitation of the current state of the art needs to be addressed. As no objective measure of a stressful work environment is available one can argue that part of the reported association may be due to common method variance or response bias. People with an elevated risk of developing affective disorders perceive their work environment in a more negative way than others, and specific personality traits such as negative affectivity or low self esteem may not only affect the responses to items of psychometric scales or interview questions, but may interact with occupational trajectories that result in less privileged working circumstances [24]. One longitudinal investigation highlighted the bidirectionality of the relationship between stressful work and affective disorder [17]. Although we cannot rule out this argument it should be noticed that at least adjusting for psychological characteristics such as negative affectivity does not invalidate the reported associations of psychosocial stress at work with depression [32, 33].

In conclusion, there is solid evidence of a prospectively established association of an adverse psychosocial work environment (high demand and low control; high effort and low reward) with depression. Moderately elevated risks are documented for men and women in a variety of occupations in economically advanced societies. Although several scientific challenges need to be met, in particular the elucidation of underlying psychobiological mechanisms, the current evidence is strong enough to address policy implications of findings. One type of preventive efforts concerns an increased awareness of physicians in assessing psychosocial risks of depressive symp-

toms and in counselling and supporting their patients. Another, even more important policy implication points to the design and implementation of theory-based measures of health-promoting working conditions.

■ **Conflict of interest statement** I hereby declare that I don't have any financial relationship with sponsoring organisations or interests that organisations represent.

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