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Psychosocial work environment and mental health—a meta-analytic review

by Stephen Stansfeld, PhD,¹ Bridget Candy, MSc¹

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Objectives To clarify the associations between psychosocial work stressors and mental ill health, a meta-analysis of psychosocial work stressors and common mental disorders was undertaken using longitudinal studies identified through a systematic literature review.

Methods The review used a standardized search strategy and strict inclusion and quality criteria in seven databases in 1994–2005. Papers were identified from 24 939 citations covering social determinants of health, 50 relevant papers were identified, 38 fulfilled inclusion criteria, and 11 were suitable for a meta-analysis. The Comprehensive Meta-analysis Programme was used for decision authority, decision latitude, psychological demands, and work social support, components of the job-strain and iso-strain models, and the combination of effort and reward that makes up the effort–reward imbalance model and job insecurity. Cochran’s Q statistic assessed the heterogeneity of the results, and the I² statistic determined any inconsistency between studies.

Results Job strain, low decision latitude, low social support, high psychological demands, effort–reward imbalance, and high job insecurity predicted common mental disorders despite the heterogeneity for psychological demands and social support among men. The strongest effects were found for job strain and effort–reward imbalance.

Conclusions This meta-analysis provides robust consistent evidence that (combinations of) high demands and low decision latitude and (combinations of) high efforts and low rewards are prospective risk factors for common mental disorders and suggests that the psychosocial work environment is important for mental health. The associations are not merely explained by response bias. The impact of work stressors on common mental disorders differs for women and men.

Key terms decision latitude; effort–reward imbalance; longitudinal studies; mental health, social support; systematic review.

It has now been over a quarter of a century since Karasek’s classic paper appeared describing the job-strain model and the effects of job strain on well-being (1). A focus on the psychosocial environment at work became more pressing once physical and toxicological hazards in the workplace were more controlled, and there has been an increasing shift from manual work towards nonmanual work (2).

Psychosocial work characteristics

Psychosocial work characteristics imply risk factors involved with psychological processes linked to the social environment of work that may be important in the causation of illness. Karasek described two key dimensions of the psychosocial work environment, psychological job demands and decision latitude, the latter

comprising decision authority (control over work) and skill discretion (variety of work and opportunity for use of skills) (1). According to his “job-strain model”, also called the “demand–control model”, jobs can be classified into four types. In “high-strain jobs” (the most risky type of job), fatigue, anxiety, depression, and physical illness can be predicted when the psychological demands of a job are high and the workers’ decision latitude in the task is low—when the worker lacks the resources to deal with demands (3). Conversely, “active jobs” can be intensely demanding; yet the workers have sufficient control over their activities and the freedom to use available skills—this type of job is associated with only average psychological strain and active leisure time (3). “Low-strain jobs”, with few psychological demands and high levels of control, are predicted to have lower than average levels of psychological strain

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and lower risk of ill health because there are relatively few challenges and decision latitude allows the worker to respond optimally to these few challenges (3). The fourth type of job is the "passive job", characterized by low demands and low control. This type is predicted to be demotivating and possibly involve atrophying of skills and abilities but only average levels of psychological strain and health risk are expected (3). Additional work by Jeffrey Johnson and Tores Theorell (3, 4) added an important further dimension of occupational social support to this model (3, 4), as it had been noted that support received from supervisors and co-workers buffered the effects of high demands and low control. This situation created the "demand-control-support" or "iso-strain" model (5). Siegrist (6) has described another model, that of effort-reward imbalance (ERI) (6). In this model, work offers opportunities for the self to gain esteem, efficacy, and integration. According to the social exchange theory, workers invest effort and expect rewards in return. If there is an imbalance in this expected exchange and workers do not receive esteem, efficacy and integration, then psychological distress occurs with physiological arousal. Thus the combination of putting in high effort at work, which may be both intrinsic effort including innate competitiveness and hostility, together with high extrinsic work demands, similar to Karasek's job demands, and receiving, by implication, in return, little reward in terms of salary, promotion, or esteem is a powerful risk factor for ill health.

Psychosocial work characteristics and common mental disorders

There is evidence from both cross-sectional (7-9) and longitudinal studies (10) that high levels of psychological demands, including fast work pace and high conflicting demands, are predictive of common mental disorders that is, largely, mild-to-moderate, depressive and anxiety disorders, frequent in the general population and identified by screening questionnaires and standardized psychiatric interviews. On the other hand, high levels of social support at work from colleagues and supervisors have been found to be protective of mental health in both cross-sectional (9) and longitudinal studies (10). Decision latitude has been associated with common mental disorders either singly or in combination with job demands to replicate Karasek's job strain model. High levels of decision latitude have been found to be protective of mental health in cross-sectional studies (11, 12).

Criticisms of the psychosocial model

Despite these early findings, the psychosocial model has been heavily criticized, especially in the realm of health

inequalities, by proponents of materialist explanations who largely believe that these two explanations are mutually exclusive and that the psychosocial explanation is incorrect (13). It has been argued that the association between work characteristics and health, usually coronary heart disease, is due to confounding by social class; poor work characteristics are merely a marker for low socioeconomic position, when it is really poverty and social disadvantage that are responsible for the association between work characteristics and health. Social disadvantage may partially confound the association between work and health, but even after adjustment for social position, and, in occupational cohorts of homogeneous social status where this confounding would not be expected, work characteristics are still important determinants of psychological distress (14).

Nevertheless, the social context of work is important, and it influences work characteristics. Work characteristics are not independent of their social setting but, instead, are situated within an organizational setting that is itself embedded in a social context. Occupational structure, in one study, was found to exert little influence on psychological distress (15). However, the consideration of work characteristics without an understanding of their social structural context has been criticized from a sociological perspective. Social hierarchies and the implicit power relationships contained therein influence the *distribution* of work-related stressors and support and even influence mediating factors such as self-esteem. Moreover, the effects of work characteristics on mental health may be partly conveyed through the symbolic meaning of work-related stressors understood in the context of power relationships that pertain to a particular occupational setting (16).

Although there has been criticism of the literature on work characteristics because of its failure to consider the wider social context of work, there have been more criticisms of the association between work characteristics and common mental disorders on methodological grounds. In particular, this situation has been related to the measurement of work characteristics on the basis of self-report with the problem of response bias (17). Could preexisting personality traits or poor mental health influence the reporting of work characteristics? People who report low self-esteem may also report adverse work conditions and be subject to poorer mental health. Negative affectivity, a mood-dispositional dimension of pessimism and negative emotionality, accounts for some of the variance in the association between work characteristics and common mental disorders, influencing both associations between job demands and job insecurity and common mental disorders (18-21). Adjustment of work characteristics by negative affectivity had little effect on the risk of psychological distress (22) or on stressor-strain relationships in a longitudinal study (23)

and adjustment for personality measures such as hostility, and attributes such as low self-esteem did not seem to explain the association between work characteristics and depressive symptoms in the longitudinal French GAZEL study (24). Negative affectivity has also been shown to be a moderator of stressor-strain relationships and may indicate greater vulnerability to the effects of stressors (25). Differences in individual vulnerability to work stressors may be another reason for the inconsistency of stressor effects across studies.

However, there may be more substantial effects in relation to prior psychological distress since work can have an impact on common mental disorders and mental health can influence perceptions of work. Evidence of reciprocal associations between demands, control, social support, and common mental disorders has been reported in several longitudinal studies (26, 27). Further work has suggested the possibility of within-person and environmental influences explaining this reverse causation. Longitudinally, reversed lagged effects of common mental disorders on perceptions of social support and demands have been found. Two within-person hypotheses were proposed to explain these findings, the "rosy perception" mechanism and the "gloomy perception" mechanism (28). Unhealthy people tended to report more negative outcomes in terms of support, demands, and control; these changes could be related to changes in perception although secular changes in the workplace may also differentially affect healthy and unhealthy people. Incomplete adjustment for these influences may explain some of the variability in the odds ratios for work characteristics and common mental disorders. In contrast to studies that rely on self-reports of work, those that have used assessments of the work environment, external to the person reporting psychological distress, have not always found associations between work and common mental disorders (22), and the lack of external assessments of work conditions has been criticized (29). However, the use of observer-rated work analysis (30) and measures of shared job strain to reduce individual variation in the response to job stressors (31) as innovative methods of counteracting response bias have yielded meaningful associations between work stressors and psychological distress. Nevertheless, most studies in this research area rely on subjective accounts of both work stressors and common mental disorders.

Many studies have been done that show a relationship between psychosocial work characteristics and mental health outcomes, ranging from symptoms and psychological distress to diagnosed psychiatric disorders. However, many of these studies have been cross-sectional and, therefore, make the causal direction between work stressors and mental health uncertain, particularly in light of the demonstrated reciprocal relationship

between work characteristics and mental health (32, 33). Moreover, results have been inconsistent across studies, especially for the job strain model. Some studies have found effects of job strain on mental health (34), others have not (33, 35), and, for some, associations have only been found for specific subscales such as skill discretion (36), job demands, and social support (22). We believe that these inconsistencies could be resolved, and the causal direction could be clarified by a meta-analysis of high-quality prospective studies of workers' perceptions of their work environment and mental health over the last decade. We hypothesize, on the basis of previous models, that the meta-analysis would yield consistent evidence that decision authority, decision latitude, high job demands, low occupational social support, the combination of putting in high effort and receiving low reward, and, independently, high job insecurity are associated with an increased risk for common mental disorders across time in longitudinal studies, the result being support for causal associations between work stressors and common mental disorders.

In order to summarize and synthesize the results of recent studies relating work characteristics to a variety of mental health outcomes, we carried out a systematic review and meta-analysis of studies reported between 1 January 1994 and 30 September 2005. The systematic review had a broad scope to identify psychosocial hazards at work.

Methods

The objective was to review relevant published quantitative studies exploring the psychosocial work environment and the incidence of common mental disorders in a systematic review. This review was carried out as part of a more extensive review of the social determinants of common mental disorders and coronary heart disease (37). The studies had to fulfill strict exposure and outcome criteria to be included in the review. They also had to include a new onset of a common mental disorder as a study outcome: neurotic disorders (WHO International Classification of Disease, version 10 (ICD-10) codes F40-F42), depressive disorders (ICD-10 codes F32-39), and suicide. These codes cover phobic anxiety disorders, other anxiety disorders, obsessive-compulsive disorder, depressive episode, recurrent depressive disorder, persistent mood disorders, other mood disorders, and unspecified mood disorders.

Our inclusion criteria for the systematic review were chosen to identify studies in which sources of bias were minimized, particularly the risk of the perception of current work characteristics being contaminated by previous psychological distress. Thus we included longitudinal rather than cross-sectional studies of working age

adults in which work characteristics were used as a predictor of common mental disorders. The study populations either needed to be free of common mental disorders at the start of the study or the presence of any earlier disease accounted for in the analysis to avoid the bias of the confounding effects of psychological distress influencing work characteristics and also independently increasing the risk of future psychological distress. There were insufficient studies within the subgroups (only two) for the methodologically most rigorous approach being adopted for selecting only studies in which participants with mental ill health at baseline were excluded. The studies also had to examine the effect of work characteristics on common mental disorders over at least 12 months to ensure that there had been sufficient exposure to work stressors for the effects on health to be observed; in addition, the study populations had to include at least 200 working adults so that there would be robust sample sizes for the statistical analysis. Studies were only included if the sample population resided in industrially established, market economy countries (Europe, North America, New Zealand, Australia, Japan, and Russia), where work conditions were likely to be broadly similar. The review was confined to English language studies published in peer-reviewed journals from 1994 to 2005, so that the systematic review would be relevant to current work conditions and also that the recent more methodologically sophisticated studies could be focused on.

Psychosocial hazards were interpreted broadly in the systematic review, and they not only included dimensions of the job strain model and the effort–reward imbalance model and job insecurity, but also similar concepts such as worktime control and questions on work scheduling or work conflict. However, for many of these identified hazards, there were too few studies (less than two) for a meta-analysis to be carried out. This lack of studies does not mean that these hazards were unimportant, instead, simply that there are, as yet, too few studies to analyze. Meta-analyses are necessarily selective and restrictive in a broad ranging research field such as work and common mental disorders. Some studies were excluded for methodological reasons (there were no odds ratios to enter into the meta-analytic models or the outcome measure was not appropriate (38–50), while in others the predictor was nonspecific work stress and did not distinguish between the component work characteristics (51–56). In addition, some had only single-item measures of work characteristics (38, 57–59), and some were duplicate papers for the same study (56, 60–61). Still, in other cases, there were too few (less than two) longitudinal studies to include in the meta-analysis (62–64). In summary, there were too few studies that measured either skill discretion or work conflict or worktime control (62) or various indices of work stress (including

questions on work schedule, pressure, stress, negative events) (49, 57) to analyze these as separate dimensions.

The psychosocial work characteristics that were included in the meta-analysis were Karasek's job-strain indices: decision latitude, decision authority, psychological demands, job strain (the combination of high demands and low decision latitude) (4), work social support measured as the quality of interpersonal relationships at work (4), the combination of high efforts and low rewards (6), and job insecurity (58). Job insecurity, although included in the effort–reward imbalance model, was considered separately, as several studies, sufficient to be included in the meta-analysis, have examined job insecurity as a potentially important independent psychosocial risk factor.

Literature searches

Data sources and search strategy. The following literature databases were searched: CINAHL, the Cochrane Trials Register, EMBASE, Medline (PubMed), PsycINFO, Science Citation Index (SCI), Social Science Citation (SSCI). Additional abstracts were retrieved for articles that were cited as references within retrieved articles. Other articles were sourced from consultation with mental health experts. In consultation with information specialists and our mental health expert group, and on the basis of search strategies used for the Cochrane Collaboration's depression, anxiety and neurosis group and descriptive terms used in key papers identified, a list of terms was compiled in the following key areas: common mental disorders, work characteristics, and study design features. [See appendix 1 for a full list of the terms used and how they were combined to form a search strategy.]

Eligibility process

With the use of a standardized eligibility form, all of the titles, abstracts, and key words of citations identified in our search were screened for eligibility by two reviewers independently. Articles that appeared by title and abstract to be eligible but, on full text review, were not eligible were screened by only one reviewer, a quarter of these exclusions being checked by a second reviewer. To ensure consistency, comparison between the reviewer's independent results was made throughout the screening process. The full text of articles was obtained and assessed by one reviewer.

Quality assessment and data extraction

Data were extracted, and papers were assessed for quality by one reviewer; a second reviewer checked each extraction. Any disagreements were discussed at a

project group meeting. To identify key study components, in particular design features and outcomes, we extracted data to a standardized form and checked them with a validity checklist. The components used in these forms were based on work from subject experts [in particular, report 4 of the NHS Centre for Research and Development, the Moose guidelines for meta-analyses and systematic reviews of observational studies (65–67)].

Summary of effect

Odds ratios were extracted for each study, when available. We chose to extract odds ratios rather than any other effect size, as they are easier to interpret than correlations. In practice, they were also found to be the most common measure used. Unless stated otherwise, odds ratios comparing the potential highest risk versus the lowest risk category of exposure (the social determinant) were reported (eg, the risk of common mental disorders for those with the lowest decision authority compared with the risk for those with the highest decision authority). If several estimates of the effect of the social determinant on common mental disorders were reported, the most highly adjusted estimate was extracted. For the sake of consistency across studies, the results were analyzed from the earliest published study, if there were more than one paper from the same study. Odds ratios were preferentially selected from samples free of psychological distress at baseline, when available, rather than from analyses in which psychological distress at baseline was adjusted for. Effect estimates reported separately for men and women were recorded.

Meta-analysis

Because of the high risk of heterogeneity in observational studies, a cautious use of meta-analysis was undertaken, summing of the effect in a meta-analysis only being considered if the predictors were similar and the study was of good quality. This process was undertaken using the Comprehensive Meta-analysis Programme, version 2 (68). When results from the fixed and random effects models differed, we presented the second, as it represented a more conservative approach. Random regression models are more conservative in the sense that the standard errors and the confidence intervals of the estimated odds ratios are larger, but the point estimates are not necessarily smaller. Cochran's Q statistic was used to test for heterogeneity (69). A Q statistic P-value of <0.05 was considered to indicate significant heterogeneity. Since heterogeneity was expected a priori, it was supplemented with a measure of the degree of inconsistency between studies, the I² statistic. This statistic provides an estimate of the percentage of the variability in outcome that is due to heterogeneity between

studies. An I² value of "0" indicates no observed heterogeneity. Values range from 0 to 100, a level of 25% being tentatively considered low heterogeneity, 50% being moderate heterogeneity, and 75% being high heterogeneity (70). When there were sufficient studies, sources of potential variability were explored by subgroup analysis.

Results

Thirty-eight papers from 21 research groups were identified that explored psychosocial work characteristics and subsequent common mental disorders. Details of the search process and numbers identified at each stage are provided in figure 1. The numbers of papers eligible for the meta-analysis were reduced to 11 (appendix 2) because 13 papers reported results in a form that could not be submitted to a meta-analysis (38–50), 6 papers only reported measures of nonspecific work stress (51–56), 4 papers reported only single-item measures of work stress (38, 57–59), one of which had already been excluded for another reason (38), 3 were papers from the same study and thus did not involve independent samples (56, 60, 61), one of which had already been excluded for another reason (56), and three work stressors were only reported in 1 longitudinal paper (62–64). The measures used to capture common mental disorders and work conditions varied, but most used validated scales. The follow-up varied from 1 to 14 years. The study samples generally included both women and men. Of the 11 papers finally included (22, 35, 61, 71–78) in the meta-analysis, 10 used a modified version of the Job Content Questionnaire as the predictor, 2 used measures of effort–reward imbalance, and 8 used symptomatic outcomes such as the General Health Questionnaire or Center for Epidemiologic Study of Depression; 3 papers had diagnostic interview outcomes.

Four research groups were identified that explored decision authority in three samples (22, 61, 71, 73). [See table 1, figure 2, and appendix 2 for descriptive details.] The summary odds ratio for low decision authority and common mental disorders was an odds ratio (OR) of 1.21 [95% confidence interval (95% CI) 1.09–1.35], a modest sized odds ratio. Low-to-moderate heterogeneity was identified (I² 24.05%). The overall summary Q-statistic was not significant [Q=3.95, df(Q) 3, P=0.267], again suggesting low heterogeneity. When the two European studies were analyzed separately from the North American study, the summary odds ratio was 1.27 (95% CI 1.14–1.42) with no heterogeneity [Q=0.773, df(Q) 2, P=0.680, I²=0%]. In contrast, in the two studies that did not adjust for past mental health, there was some heterogeneity [Q=1.11, df(Q) 1, P=0.293, I²=9.46%].

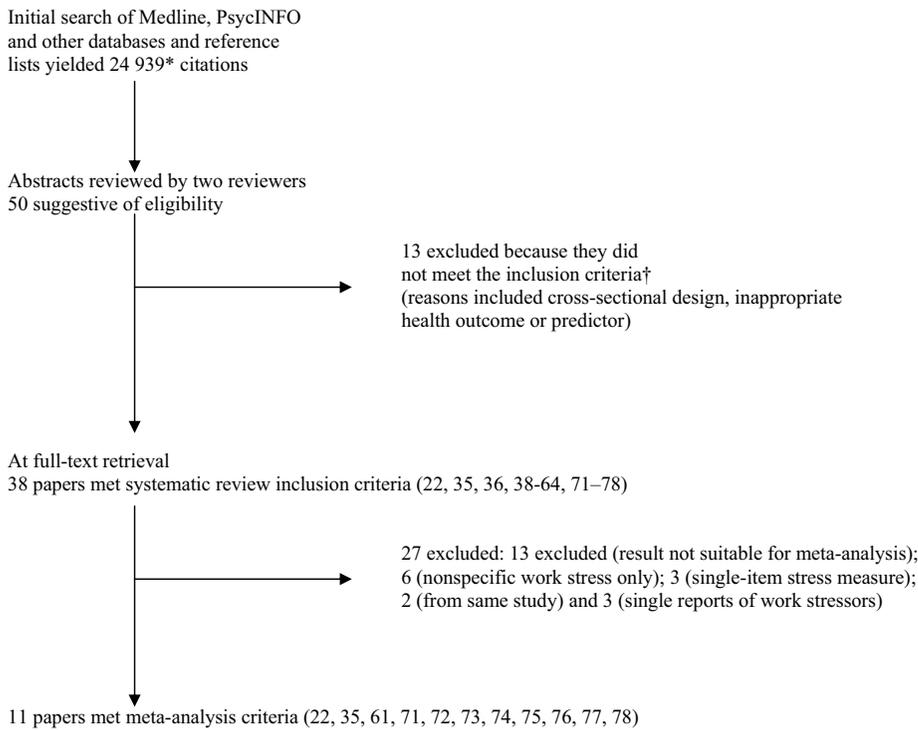


Figure 1. Search strategy. [* = the number of citations is large as the search for evidence on the effect of work characteristics and common mental disorders was undertaken in a combined search for a larger project on the social determinants of coronary heart disease (CHD) and common mental disorders, † = a list of the 13 excluded papers is available from the authors]

Table 1. Meta-analysis of adverse psychosocial work characteristics and the risk of common mental disorders. (OR = odds ratio, 95% CI = 95% confidence interval)

Group	Estimates (N)	Point estimate		Heterogeneity tests		References
		OR	95% CI	Q-test p	I sq	
Decision authority						
All	4	1.21	1.09–1.35	0.267	24.1	Stansfeld et al, 1999 (22); Marchand et al, 2005 (61); Kivimäki, 2003 (71); Wang & Pattern, 2004 (73)
Decision latitude						
All	6	1.23	1.08–1.39	0.111	44.19	Bultmann et al, 2002 (35); Niedhammer et al, 1998 (74); Griffin et al, 2002 (75)
Psychological demands						
Men	3	1.55	1.29–1.85	0.033	70.7	Stansfeld et al, 1999 (22); Bultmann et al, 2002 (35); Niedhammer et al, 1998 (74)
Women	3	1.34	1.16–1.53	0.725	0	Stansfeld et al, 1999 (22); Bultmann et al, 2002 (35); Niedhammer et al, 1998 (74)
All	8	1.39	1.15–1.69	0.0001	92.0	Stansfeld et al, 1999 (22); Bultmann et al, 2002 (35); Marchand et al, 2005 (61); Kivimäki, 2003 (71); Niedhammer et al, 1998 (74)
Job strain						
All	3	1.82	1.06–3.10	0.093	58.0	Ylipaavalniemi et al, 2005 (76); Shields, 1999 (77)
Social support						
Men	3	1.38	1.20–1.60	0.029	71.8	Stansfeld et al, 1999 (22); Bultmann et al, 2002 (35); Wang & Pattern, 2004 (73)
Women	3	1.20	1.07–1.35	0.653	0	Stansfeld et al, 1999 (22); Bultmann et al, 2002 (35); Wang & Pattern, 2004 (73)
All	8	1.32	1.21–1.44	0.063	47.8	Stansfeld et al, 1999 (22); Bultmann et al, 2002 (35); Wang & Pattern, 2004 (73); Niedhammer et al, 1998 (74); Ylipaavalniemi et al, 2005 (76)
Effort-reward imbalance						
All	4	1.84	1.45–2.35	0.610	0	Stansfeld, 1998 (72); Godin et al, 2005 (78)
Job insecurity						
All	3	1.33	1.06–1.67	0.201	37.7	Bultmann et al, 2002 (35); Marchand et al, 2005 (61); Stansfeld, 1998 (72)

The summary odds ratio for the three studies that identified decision latitude (35, 74, 75), as opposed to decision authority or skill discretion, was 1.23 (95% CI 1.08–1.39). [See table 1, figure 3, and appendix 2 for descriptive details.] The odds ratio for decision latitude

was similar in size to that for decision authority. A moderate level of heterogeneity was identified by the I² test (I²=44.19%). The overall summary Q statistic was not significant [Q=8.96, df(Q) 5, P=0.111], suggesting low heterogeneity. There was less heterogeneity when the

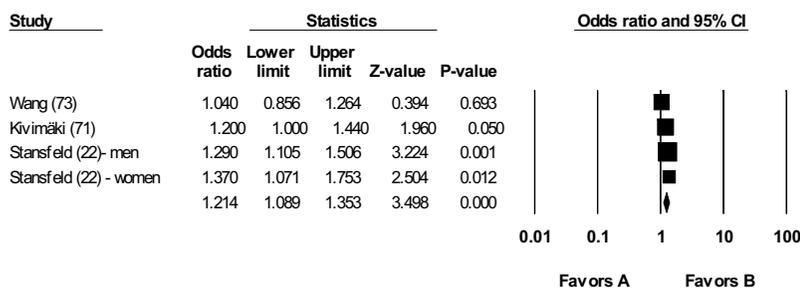


Figure 2. Decision authority and common mental disorders (studies listed by first author). [Marchand, 2005 (61) not included in the analysis as the sample overlapped with Wang 2004]

Meta Analysis

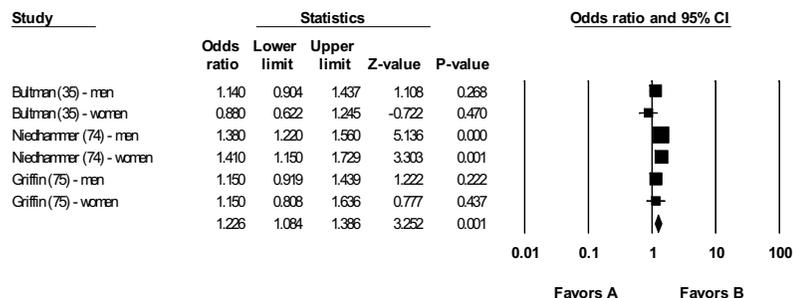


Figure 3. Decision latitude and common mental disorders (studies listed by first author).

Meta Analysis

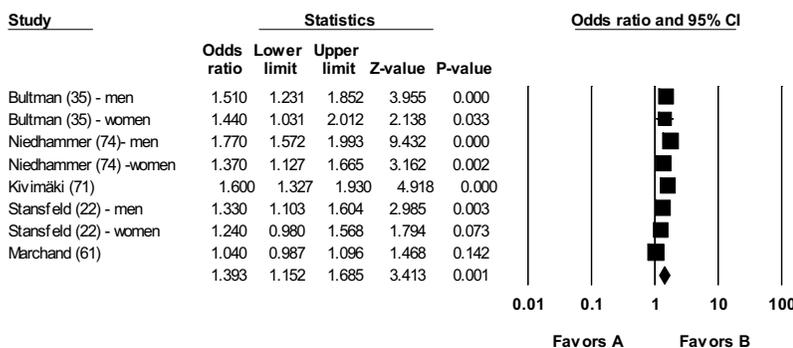


Figure 4. Job demands and common mental disorders (studies listed by first author).

two European studies were examined alone {OR=1.33 [95% CI 1.21–1.46, Q=2.93, df(Q) 3, P=0.403, I²=0%]}. In the two studies that adjusted for mental health at baseline rather than the study that chose a sample free of mental ill health at baseline, there was a similar degree of heterogeneity to the main sample [Q=7.61, df(Q) 3, P=0.055, I²=60.56%].

A positive association was found for all of the papers exploring the effects of psychological demands on common mental disorders (22, 35, 51, 61, 71, 73, 74). [See table 1, figure 4, and appendix 2 for descriptive study details.] The overall summary estimate of the risk of common mental disorders for those with the highest psychological demands was 1.39 (95% CI 1.15–1.69). This overall odds ratio was moderate in size. The summary risk was higher for men [odds ratio (OR) 1.55,

95% CI 1.29–1.85) than for women (OR 1.34, 95% CI 1.16–1.53). A high level of heterogeneity [Q=87.7, df(Q) 7, P=0.0001, I² 92.0%] was identified in the overall summary score, and it was explained by a high level of heterogeneity between the male samples [Q=6.83, df(Q) 2, P=0.033, I² 70.7%]. However, there was negligible heterogeneity between the studies of women [Q=0.644, df(Q) 2, P=0.725, I² 0%]. A high level of heterogeneity also remained if European [Q=12.45, df(Q) 4, P=0.014, I²=67.87%] and North American [Q=15.09, df(Q) 2, P=0.001, I²=86.75%] studies were examined separately. High levels of heterogeneity were present when the studies had adjusted for mental ill health at baseline [Q=12.36, df(Q) 5, P=0.030, I²=59.54%] and when they had not adjusted for mental ill health at baseline [Q=18.85, df(Q) 1, P=0.001,

$I^2=94.69\%$], although the heterogeneity was greater if they had not adjusted for mental health at baseline.

Fewer studies were identified that explored the effects of job strain on common mental disorders (50, 76, 77). [See table 1, figure 5, and appendix 2 for study details.] The size of the summary point estimate for job strain was substantial, and it was among the two highest for the psychosocial work characteristics (OR 1.82, 95% CI 1.06–3.10). Moderate heterogeneity was identified by the I^2 test ($I^2=58.0\%$). The overall summary Q-statistic was not significant [4.76, $df(Q)$ 2, $P=0.093$], indicating low heterogeneity. There were too few studies to test the heterogeneity of the subgroups.

Seven research groups were identified that explored aspects of interpersonal work relationships (22, 35, 39, 41, 73, 74, 76). [See table 1, figure 6, and appendix 2 for descriptive details.] They included the level or type of social support from colleagues or supervisors or the presence of interpersonal conflict. Five of the seven studies found a significant association between poor work relationships and mental ill health. Two studies presented data in a way that could not be used in a meta-analysis (39, 40). A modest increased risk (OR 1.32, 95% CI 1.21–1.44) was found in the meta-analysis of all studies for the effect of poor interpersonal relationships on common mental disorders. The overall summary Q statistic estimated a borderline significant level of heterogeneity [13.4, $df(Q)$ 7, $P=0.063$], and the I^2 had a moderate level of heterogeneity (47.8%) that suggested

some variation between the studies. The associations were stronger for the men (OR 1.38, 95% CI 1.20–1.60) than for the women (OR 1.20, 95% CI 1.07–1.35), but there was more heterogeneity in the male [$Q=7.11$, $df(Q)$ 2, $P=0.029$, $I^2=71.8\%$] than the female [$Q=0.85$, $df(Q)$ 2, $P=0.653$, $I^2=0\%$] subgroup analyses. In the subgroup that adjusted for mental health at baseline, the odds ratio was similar in size (OR 1.31, 95% CI 1.17–1.45) to that of the two studies that did not adjust for mental health at baseline (OR 1.35, 95% CI 1.16–1.58); however, there was more heterogeneity in the former [$Q=12.74$, $df(Q)$ 5, $P=0.025$, $I^2=60.8\%$] than in the latter [$Q=0.67$, $df(Q)$ 1, $P=0.414$, $I^2=0\%$]. There was a smaller effect size [OR 1.25 (95% CI 1.12–1.40)] but less heterogeneity in the North American studies [$Q=0.91$, $df(Q)$ 2, $P=0.636$, $I^2=0\%$] than in the European studies. The observed heterogeneity may partly be due to the variation in the measurement of interpersonal relationships and common mental disorders.

There were two longitudinal studies of effort–reward imbalance (72, 78). [See table 1, figure 7, and appendix 1 for study details.] The summary point estimate showed a substantial effect (OR 1.84, 95% CI 1.45–2.35), with little evidence of heterogeneity [$Q=1.82$, $df(Q)$ 3, $P=0.610$ on the Q test, $I^2=0$]. There were too few studies to test the heterogeneity of the subgroups.

There were also studies of job insecurity and common mental disorders (35, 58, 61,73) (figure 8). In three studies of job insecurity, the point estimate was 1.33

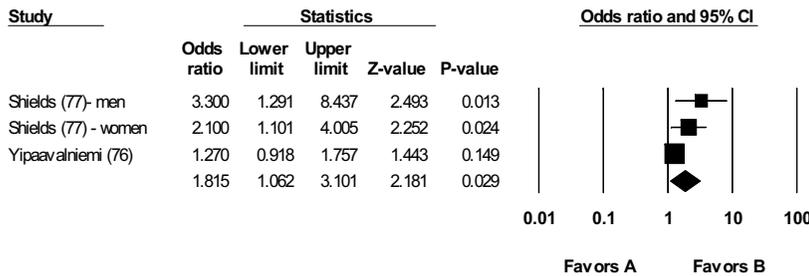


Figure 5. Job strain and common mental disorders (studies listed by first author). [Bildt, 2002 (50) not included as risks expressed as relative risks not odds ratios]

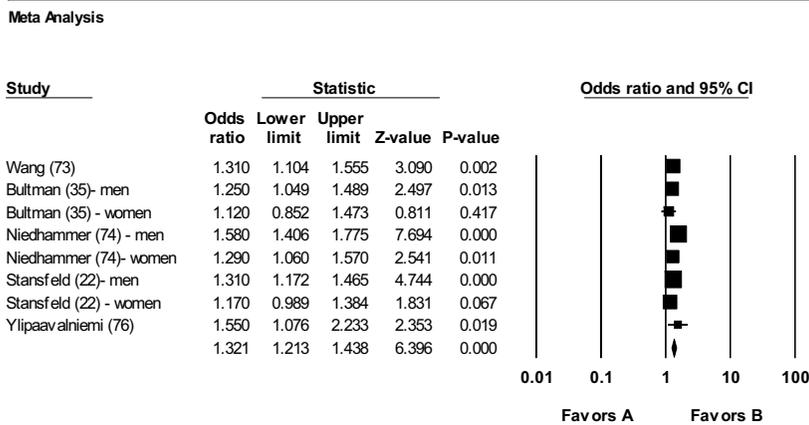


Figure 6. Low social support and common mental disorders (studies listed by first author).

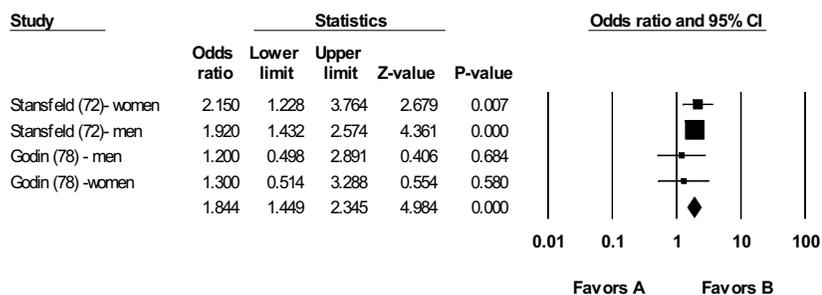


Figure 7. Effort and reward imbalance and common mental disorders (studies listed by first author).

Meta Analysis

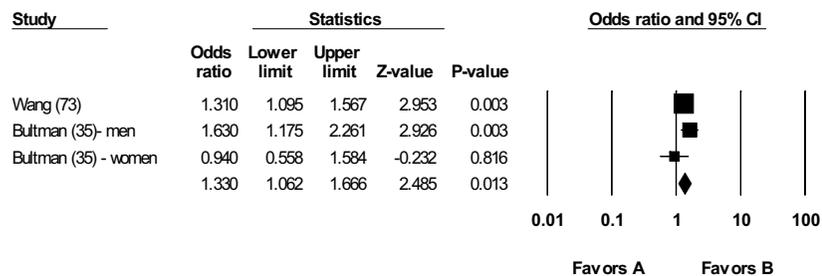


Figure 8. Job insecurity and common mental disorders (studies listed by first author).

Meta Analysis

(95% CI 1.06–1.67) (35, 61, 73), a modestly sized estimate. There was low heterogeneity [Q=3.21, df(Q) 2, P=0.0201] and an I² value of 37.7%. One study could not be included because the effects were expressed as mean differences in the psychological distress scores (58). There were too few studies to test the heterogeneity of the subgroups.

Discussion

In the meta-analysis, the strongest prospective associations were found for the combination of decision latitude and psychological demands (high job strain) and the combination of putting in high effort and receiving low reward (effort–reward imbalance) and common mental disorders, consistent with causal associations. Thus the meta-analysis provides consistent robust summary evidence for causal effects for high job strain and effort–reward imbalance. The summary statistics showed that low decision authority, low decision latitude, high job demands, low occupational social support, and job insecurity were associated with a moderate risk of common mental disorders; this finding supports our initial hypothesis. This finding is also in keeping with a recent narrative review of “high-quality” studies, which found good evidence of causal effects of work characteristics on well-being in longitudinal

studies, the definition of “high-quality” studies being based on the design (panel design with all variables measured twice or more), time lags, referenced measures with psychometric data, more than correlational analysis, and an analysis of nonresponse (79). One advantage that distinguishes this review from previous reviews is that it was more focused on common mental disorders than on including a range of more-or-less linked outcomes, such as well-being, happiness, job satisfaction, and coronary heart disease. This evidence from longitudinal studies suggests that the psychosocial environment at work is important for health and that these associations are not merely a form of response bias.

The risk for mental ill health being higher in association with high job strain rather than with its constituents may be because the composite measure captures the adverse work conditions better. As is illustrated later in this discussion, high demands in a context of high resources is associated with less risk than with high demands coupled with low resources, measured in these studies as low decision latitude. However, because of the small number of studies measuring this composite scale, there is a risk of the finding being one of chance and the lack of heterogeneity being related to the small number of studies. The effects of demands and decision latitude seem to be additive rather than multiplicative; therefore Karasek’s original hypothesis of an interaction between high demands and low control was not confirmed. However, as de Lange and her colleagues

(79) have remarked, the nature of the interaction is ambiguous, and it is probably legitimate to accept both additive and multiplicative interactions as support for the model. In two cross-sectional studies, high job strain, the combination of high demands and low decision latitude, has been shown to be associated with a higher prevalence of psychiatric morbidity, as rated by a clinical interview schedule, among teachers (80) and higher rates of major depressive episode, depressive syndrome, and dysphoria, as measured by the diagnostic interview schedule in the Baltimore sample of the Epidemiologic Catchment Area Program (34). The advantage of these two studies, and that of Weinberg & Creed (81), is that they used structured interview measures of psychiatric morbidity that are likely to be more valid as assessments of common mental disorders than the nonspecific psychological distress scales or the depressive symptom scales used in most occupational epidemiologic studies.

Effort–reward imbalance was strongly associated with an increased risk of common mental disorders. This association was also found in a narrative review of longitudinal and cross-sectional studies of the effort–reward imbalance model, in which high effort and low reward were associated with the less specific outcomes of psychosomatic symptoms in 13 out of 15 studies and job-related well-being in 5 out of 6 studies (82). The incorporation of intrinsic effort and overcommitment to work probably strengthened these associations since they include aspects of individual differences that are likely to be very relevant to the risk of common mental disorders and are excluded in the environment-focused job-content instrument. Overcommitment alone in six studies predicted 1.92–5.92 times the risk of various psychological outcomes, although results of the interaction between effort–reward imbalance and overcommitment, implying added vulnerability for overcommitted individuals with effort–reward imbalance, was inconsistent (82).

There was a high degree of heterogeneity in the results of the individual studies of psychological demands and, to a less extent, in the results of the studies on social support. This was less the case for decision authority and decision latitude. Part of the heterogeneity for interpersonal relationships may be related to the variation in the measures used, although only the studies of positive interactions or their absence and not work conflict were included in the meta-analysis. In the meta-analysis, the measures of social support were largely comparable across the studies inquiring about support from supervisors and co-workers. The GAZEL study (74) only asked about co-worker support, but the greater magnitude of the odds ratios for social support in this study was more likely due to adjustment for psychiatric sickness absence at baseline rather than to a more stringent measure of common mental disorders, as in most

of the other studies that adjusted for their dependent measure at baseline. Lack of social support is usually differentiated into support from supervisors and colleagues, as well as into the clarity and consistency of information from supervisors. Some previous studies have found that support from supervisors is more important for mental health than support from colleagues is, although this outcome may differ by workplace (22).

Heterogeneity may also reflect differences in the exclusion of or adjustment for mental health at baseline—the studies that seemed to be more rigorous in excluding or adjusting for mental health at baseline (22, 35, 73) had lower odds ratios than those that reported odds ratios without exclusion of baseline ill health (76) or adjusted only for psychiatric sickness absence (74). However, this possibility does not explain the greater heterogeneity between men than women. The social support instruments focus on emotional support. It may be that emotional support is more recognizable by women than by men, and, in keeping with women more readily perceiving social support, there is less variation in the perceptions of support needed or received. However, this explanation is in contradiction to the odds ratio for lack of social support being greater for men than for women. Certainly, the sources of personal support differ between women and men (83), and it may be that, since more women work part-time than men in many countries and work roles are more salient for men than for women (84), women tend to seek support more outside work, while men get a fair amount of their social support from work colleagues and supervisors.

Psychological job demands are diverse, and much heterogeneity was found, especially for men versus women and to a less extent for studies that did not adjust for baseline mental ill health or used a more severe measure of baseline health, such as sickness absence, that may not have accounted for milder common mental disorders (74). The heterogeneity of results may stem from which confounding variables are included as covariates for adjustment. If variables such as self-esteem, locus of control, and sense of coherence, which may mediate the association between work characteristics and common mental disorders, are adjusted for as confounding factors, the size of the risk estimates is much diminished, as became the case in Marchand et al's comprehensive study with the Canadian national population health survey (61). A further issue that may have reduced the size of the effect of demands in this study was that this effect was only measured by a 2-item scale. In addition, the effects of work stressors were nested within occupations, and, while occupation only accounted for a small amount of the variance in common mental disorders as a whole, it may have accounted for part of the effect of demands on common mental disorders.

The results suggest much more consistency, but smaller effects, among women than among men. Could this difference be due to women being more reliable reporters of demands than men or could it be due to the majority of women in these cohort studies being occupied in lower status jobs in which demands are more uniform? Many studies have pointed out that women occupy different occupational roles than men, and they may have different work conditions (85), whereas, for men, particularly in higher status jobs, demands may be different and have a different meaning. In Karasek's "active jobs", a certain amount of job demand is stimulating and boosts self-esteem. In the Whitehall II study of civil servants in the United Kingdom, high levels of job demand were associated with high employment grades, largely occupied by men (86). Several studies have found a nonlinear association between job demands and psychological distress (87–89). This finding is in keeping with jobs with low demands (ie, boring, monotonous jobs) being stressful, jobs with moderate demands being beneficial, and jobs with high levels of demand also being stressful for mental health but this stress also being buffered by adequate resources and decision latitude. Thus the predominance of blue-collar workers in the GAZEL study may explain why the effects of demands were stronger in this study (74) than in the predominantly white-collar Whitehall II study (22). Demands are also diverse in nature. Physical and emotional demands have been identified, the emotional demands being related to dealing with the difficult emotions of others, and there is some evidence that these specific aspects of demands relate to different outcomes for common mental disorders (90), but may also be as strong risk factors for common mental disorders as generic psychological demands are (35). The type of measure used for common mental disorders does not seem to be relevant with respect to the size of the effects of job demands; most used nonspecific distress measures. However, the largest effects were found in a study using a measure of specifically depressive symptoms (74). Heterogeneity due to whether the studies were from Europe or North America was difficult to interpret. For decision latitude and decision authority, heterogeneity was higher in North America, but, for support, heterogeneity was lower in North America, and, for demands, the results were similar.

There were fewer studies of job insecurity, and some of the most important did not present results as odds ratios (58). In another study from the same group, odds ratios for psychological distress were presented [for chronic job insecurity: women OR 1.10 (95% CI 0.8–1.5) and men OR 1.56 (95% CI 1.3–1.9) in the executive agencies study and women OR 1.06 (95% CI 0.7–1.7) and men OR 1.16 (95% CI 0.9–1.5) in the Properties Services Agency Study], but job insecurity was de-

finied by work outcome measured at follow-up rather than by a prospective method using a questionnaire (91). While this approach has undoubted pragmatic validity, the methodological difference made it difficult to justify combining the results with those of other studies.

Limitations

Our meta-analysis of only 11 studies had limitations even though the studies were of good methodological quality. In particular, it was difficult to carry out adequate subanalyses because of the insufficient numbers of studies. We believe this study is valid, however, as we used rigorous inclusion criteria, but the precision of the estimates is threatened by the small number of studies included. In this research field meta-analyses may be subject to publication bias because negative studies are less likely to be published, and thus the estimates reported may overestimate the size of the effects (92). Selection bias seems less likely because we did an extensive literature search of the relevant time period, in addition to consulting a panel of experts to check whether we had made any major omission in our final list of eligible studies. However, it is possible that we missed studies that could have been included. Selection bias may also have occurred, as we excluded all but the most methodologically sound studies from the review, and, therefore, important research findings may have been lost. This possibility reflects the strength of systematic reviews over narrative reviews in that the reader is clear as to the basis on which the studies have been selected and in that the review is less prone to other bias that weaker studies are more prone to. A similar criticism is that the necessarily rigorous inclusion criteria for a meta-analysis mean that many studies that identified work-related hazards in the systematic review were not included in the final meta-analysis. For example, organizational justice has been explored by a Finnish group (60, 63, 71) in a large sample of male and female hospital workers, cross-sectionally and longitudinally in relation to common mental disorders. Using various measures of common mental disorders at different time points, organizational justice was related to an increased risk of common mental disorders for both men and women. Prolonged workplace bullying was associated with a fourfold increased risk of common mental disorders 2 years later in a large sample of female and male hospital employees in Finland (64). Racial or ethnic discrimination has also been found to be associated with an increased risk of common mental disorders in a study in the United Kingdom (93). Long workhours (>35 hours per week) (42, 77) and shift work have been found to be associated with common mental disorders. The association of evening shifts with mental ill health may also suggest a selection factor in that people who

are distressed may choose certain shifts. However, for the studies that were included in the meta-analysis, we are able to have more confidence in the magnitude of the effect than for the studies not subject to the meta-analysis.

Mechanisms of the effects of work characteristics with respect to common mental disorders

The causal association between work characteristics and common mental disorders would be strengthened by an understanding of the underlying mechanisms. Work characteristics, particularly low decision latitude, have been found to be risk factors for another health outcome, coronary heart disease, although the pattern has been less consistent than it has been for psychological distress (94, 95). The putative mechanism underlying these associations is the stress hypothesis, for which (96) excessive demands, low control over work, and low support raises arousal and leads to neuroendocrine and metabolic changes, distortion of homeostatic mechanisms, and disturbance of coagulation. Low control at work has been specifically linked to higher fibrinogen levels, a finding suggesting associations with inflammatory and even immunological processes (97). However, for common mental disorders, these biological changes may be mediated through psychological pathways. In terms of psychological mechanisms, Cole and his colleagues have found that the impact of a composite work stressor measure for psychological distress is almost entirely explained by mediation through self-esteem and mastery (98). This finding suggests that poor work conditions may affect mental health through a devaluation of people's feelings of self-worth and an erosion of feelings of mastery over the work situation (16). Unmeetable demands and little control over work may undermine beliefs of mastery over work. Conflict at work and poor social support may reduce self-esteem. This possibility also implies that these processes could work in reverse, high levels of control and support boosting mastery and esteem. This possibility could explain why the associations are stronger between perceptions of work and common mental disorders than between objectively measured work characteristics and common mental disorders. In this formulation, work stressors directly influence conceptions of self and mastery. Low self-esteem and declining mastery are intervening factors between poor work conditions and psychological distress, as they are mediating factors between life events and depression (99–101). At the same time, it is possible that low self-esteem and an external locus of control denote preexisting personal vulnerability that may make a person more at risk for common mental disorders when faced with work stressors (25). Thus low self-esteem and an external locus of control

may be both mediating and moderating factors. The putative mechanism for the effort–reward imbalance model is similar. It assumes that occupational status can provide opportunities to increase self-esteem and mastery through effective role performance, but the outcome depends on a balance between the effort expended and the reward bestowed (6). If this balance does not occur and effort outweighs reward, then psychological distress and arousal of the autonomic nervous system ensues.

Nevertheless, personality and type of work are related. Certain occupations suit particular personalities, and people choose to work in these occupations or are preferentially selected into such jobs (102). Therefore, certain aspects of personality may render a person more vulnerable, or more resilient, to the psychosocial work environment (24). It is also possible that there are negative selective factors related to common mental disorders operating on work conditions over the life course. For instance, poor mental health in childhood, itself a predictor of adult mental ill health, may compromise educational achievement and lead to limited occupational opportunities in association with unfavorable work characteristics (103). Mental ill health in adulthood may also lead to selection into jobs with poor work characteristics. In both of these eventualities a spurious association could arise between work characteristics and current common mental disorders.

Concluding remarks

The combination of high psychological demands and low decision latitude (job strain) and the combination of high effort at work and low reward (effort–reward imbalance) both demonstrate a consistently increased risk for common mental disorders. The odds ratios for common mental disorders in association with decision authority, decision latitude, job demands, social support, and job insecurity are more modest and may be partly confounded by earlier mental ill health. The heterogeneity of the odds ratios for social support and psychological demands among men is unexplained although the different meaning and burden of demands according to social status may contribute to the heterogeneity between studies of demands among men. There is scope for further research on the relationship between objectively measured job stressors and common mental disorders, on the mediating pathways between work characteristics and common mental disorders, and the pathways from prior mental ill health to current work conditions and common mental disorders. There is also a need for many more intervention studies to test whether modifying work-related stressors leads to better mental health in working populations, which was ultimately the goal of this body of research.

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Appendix 1

Search terms used in the systematic review

Mental disorder

mental health OR mental illness OR mental illnesses OR mentally ill OR psychiatric OR mental disorders OR mental disorder

Anxiety

anxiety OR anxiety disorder OR anxiety disorders OR stress disorder OR stress disorders OR phobic disorder OR phobic disorders OR panic disorder OR panic disorders OR obsessive-compulsive disorder OR compulsive behaviour OR obsessive behaviour

Mood

mood OR mood disorder OR mood disorders OR seasonal affective disorder OR depression postpartum OR depression involuntional OR depression OR dysthymic disorder OR dysthymic disorders OR depressive disorders OR depressive disorder

Self-Injurious behavior

self-injurious behaviour OR suicide OR suicide attempted OR self injurious OR self mutilation OR self destructive OR self harm

Somatoform disorders

somatoform disorder OR somatoform disorders OR hypochondriasis OR conversion disorder OR neurasthenia

Other common "mental" disorders

fatigue syndrome chronic OR stress psychological OR sexual dysfunction psychological OR affective symptoms OR hysteria OR neurotic disorder OR neurotic disorders OR adjustment disorders OR adjustment disorder OR sleep disorder

Terms used to describe work characteristics

job strain OR job insecurity OR work demand* OR social support* OR work control OR decision latitude OR effort-reward OR organisational hierarchy OR job opportunit* OR promotion prospects OR hectic OR work pace OR work conflict OR monotony OR work variety OR job satisfaction OR job strain OR workload OR stress work OR Stress job OR Stress occupation OR tight deadlines

Study design

cohort OR longitudinal OR cohort studies OR comparative study OR evaluative study OR systematic review* OR meta-analysis

'Determinant' terms

risk factor* OR predict* OR determinant* OR causality OR incidence OR course OR prognos*

(* = the search did not exclude terms that were plurals or alternative wording endings; for instance, the expression opportunit* would allow the search to search for the term 'opportunities' and the term 'opportunity'. Or, and, not are expressed as they would be in a literature database search as 'OR' 'AND' 'NOT', their meaning remains the same)

Appendix 2

Work characteristics and mental health—tables of individual studies

Direction and strength of evidence, best evidence

The review synthesis of findings from each study provided an estimate of the strength of evidence for each type of social determinant. This estimate included a summing of the strength of evidence by odds ratio, from design limitations, in particular bias, and from the consistency of findings across studies.

The strength of evidence: the odds ratio

Based on the method applied by the Hemingway & Marmot group in their systematic review of psychosocial factors and coronary heart disease [Hemingway H, Kuper H, Marmot M. Psychological factors in primary and secondary prevention of coronary heart disease: an updated systematic review of prospective cohort studies. In: Yusuf, editor. Evidence based cardiology. 2nd ed. BMJ Books; 2003], the direction of evidence for each study was summarized in the tables according to the main findings that follow. This method provided a summary of the effect in terms of (i) whether there was a relationship between the social determinant and the outcome, (ii) the strength of the association, and (iii) the direction of the association, as follows:

Symbol

‘0’ = OR of 0.75-1.50, suggesting a lack of clear association.
 ‘+’ = OR \geq 1.50 and $<$ 2.00, suggesting a moderate positive association.
 ‘+ +’ = OR \geq 2.00, suggesting a strong positive association in that the risk is at least doubled
 ‘x’ or ‘-’ = OR $<$ 0.75, ‘x’ suggesting a protective association, *in that the presence of the determinant decreased the risk, such as perhaps greater years in education*, or ‘-’ suggesting a finding that did not support the original hypothesis. The symbol selected was based on the main aim or hypothesis of the study.

Table 1. Descriptive data for the studies included in the meta-analysis [the odds ratio (OR) or relative risk and 95% confidence intervals (95% CI) for the groups in the studies are presented in table 2]. (CMD = common mental disorders, CES-D = Center for Epidemiologic Study of Depression, UK = United Kingdom, SF-36 = Short-Form-36 General Health Survey, GHQ = General Health Questionnaire, CIDI = Composite International Diagnostic Interview, CIS = Clinical Interview Schedule)

Reference	CMD outcome(s) & how measured	Psychosocial work characteristics	Sample	Fol- low up se/record (years) linkage	Respon- se/recor d	Adjustments	Direction of evidence from odds ratios
Niedhammer, et al 1998 France (74)	Depressive symptoms: CES-D	Psychosocial factors at work: 16-item questionnaire: 5 items psychological demands, 6 items decision latitude, 5 items social support (Karasek et al, 1998 ^a)	11 552 male and female employees aged 41–56 years at baseline	1	Baseline 74%, follow-up 92%	Age, marital status, number of children, education, history of mental disorder, occupation, stressful personal life	Depressive symptoms and stress work events male = +, female = ++/high demand, male = +, low decision latitude = 0/low social support and male = +, low employment grade = ++
Stansfeld et al, 1998 UK (72); Stansfeld et al, 1999 UK (22)	Psychiatric disorder (SF-36 general mental health scale, GHQ)	Work characteristics: job strain models and work social support; Karasek & Theorell, 1990 ^b : derived version of job-content instrument [25 items: job demands (4 items), decision latitude (15 items), social support (6 items)]; Siegrist effort–reward imbalance	10 308 male and female employees aged 35–55 years	Up to 8	Overall response 73%	SF-36 general mental health scale: age, employment grade, baseline physical and psychological illness; GHQ: age, employment grade, baseline work characteristics and baseline GHQ score	Poor psychological function and effort-reward imbalance = + +, poor social support, male and low decision authority = +; GHQ caseness and effort–reward imbalance male = ++, female = +
Shields, 1999 Canada (77)	Major depressive episode: CIDI	Working more than 35 hours a week, 7-item job-strain scale; single items on social support, job insecurity	3830 male and female employees aged 25–45 years	4–5	Baseline 89%, follow-up 94%	Employment grade, self-employed, shift worker, work stress, age, married, children in household aged less than 12, education household income	Depressive episode and long workhours: female = ++, male = 0, high job strain = ++

(continued)

Table 1. Continued.

Reference	CMD outcome(s) & how measured	Psychosocial work characteristics	Sample	Follow-up (years)	Response/record linkage	Adjustments	Direction of evidence from odds ratios
Bultmann et al, 2002 Netherlands (35)	Psychological distress: GHQ	Job strain: Dutch version of job content questionnaire: psychological demands 5 items, decision latitude 9 items, social support 8 items, emotional demands 5 items	12 095 male and female employees aged 18–65 years	1	Baseline 45%, follow-up 80%	Age, educational level, living alone, employment status, presence of disease and baseline CIS score	Psychological distress and male and work psychological demands/emotional demands/conflicts with supervisor = +
Griffin et al, 2002 UK (75)	Depression and anxiety: GHQ	Low control at work and home (Karasek & Theorell, 1990 ^b): derived job content instrument, decision latitude 15 items	8318 civil servant employees aged 35–55 years	5	Overall 73%	Age, employment grade, marital status, children at home, caregiving status	Anxiety male and low home control = +; depression and low home control, high employment grade = +/lower employment grade = + +; anxiety female and work and home control = +, depression, middle grade low decision latitude = +; female, low home control and middle to low employment grade = + +
Kivimäki et al, 2003 Finland (71); Ylipää-valniemi et al, 2005 Finland (76)	2003: health: minor psychiatric morbidity: GHQ-12; 2005: depression: physician-diagnosed (reported)	2003: organizational justice: scales designed for project: (1) job control: job content questionnaire, (2) job demands: 4 item scale referenced, (3) job strain (job demand and job control), team climate: team climate inventory covering whether interpersonal atmosphere is supportive, support for innovation, shared vision, commitment to excellence	Hospital employees (2003: 7375 male and female; 2005: 4815 of which 4278 women, 537 men)	All 2 years	Baseline (2003: 77%, 2005: 74%)	2003: age, gender, income, health indicator at baseline, current smoking, high alcohol consumption, sedentary lifestyle, obesity, and adjustment for psychological factors found to be significant predictors of health in initial model; 2005: age, gender, income, high alcohol intake, current smoker, sedentary lifestyle, obesity	Psychological distress and high workload = + (procedural justice, relational justice, decision authority, and hostility = 0)
Wang et al, 2004 Canada (73)	Major depressive episodes: CIDI	Perceived work stress: job content on skill discretion, decision authority, psychological demands, job insecurity and physical exertion	7371 male and female employees	1	92% follow-up	Gender, marital status, family income, negative life events, level of decision authority	Major depressive episode and aspects of work stress = 0, combined score = +
Godin et al, 2005 Belgium (78)	Mental health: symptom checklist 90	Cumulative work stress; effort and reward imbalance; used referenced questionnaire: effort–reward imbalance questionnaire (Siegrist)	1986 male and female employees in four companies	1	52% at follow-up	Age, education, threat from global economy, job satisfaction, workplace instability	Effort-reward imbalance and CMD = 0.
Marchand et al, 2005 Canada (61)	Psychological distress: CIDI, Karasek job content questionnaire	Skills utilization, decision authority, physical and psychological demands, social support and job in security	7311 employees working at least 15 hours per week; baseline mean age 37 years; 46% female. Using Canada's National Population Health Survey 1994–2001	7; measured at four time-points	Overall attrition 21%	Marital status, age of off-spring, economic status, couple strain, children strain, gender, age, physical health, self-esteem, control, cohesion, alcohol consumption, smoker, physical activity, childhood stressful events, work-hours, work schedule, physical demands, social support outside of work, time-point	Psychological distress and poor psychosocial work conditions = 0

^a Karasek et al, 1998 = Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. *J Occup Health Psychol.* 1998;3(4):322–55.

^b Karasek & Theorell, 1990 = Karasek R, Theorell T. *Health work: stress, productivity and the reconstruction of the working life.* New York (NY): Basic Books; 1990.

Table 2. Odds ratios or relative risks of the groups of the studies included in the meta-analysis. (95% CI = 95% confidence interval, UK = United Kingdom)

Study	Results					
	Men		Women		All	
	Odds ratio	95% CI	Odds ratio ^a	95% CI	Odds ratio ^a	95% CI
<i>Niedhammer et al, 1998 (74)</i>						
Depressive symptoms and work						
Stressful work						
One event	1.57	1.37–1.79	1.44	1.14–1.82	..	..
Two events or more	1.73	1.40–2.14	2.04	1.47–2.85	..	..
High demand	1.77	1.57–1.99	1.37	1.13–1.67	..	..
Low decision latitude	1.38	1.22–1.56	1.41	1.15–1.73	..	..
Low work social support	1.58	1.41–1.78	1.29	1.06–1.57	..	..
<i>Stansfeld et al, 1998 UK (72); Stansfeld et al, 1999 UK (22)</i>						
Poor psychological functioning						
Low decision latitude	1.46	1.15–1.85	1.17	0.82–1.66	..	..
Effort reward imbalance	1.92	1.43–2.57	2.15	1.23–3.77	..	..
General Health Questionnaire cases (1999)						
Low decision authority	1.29	1.1–1.5	1.37	1.1–1.8	..	..
Low skill discretion	1.11	0.9–1.3	1.09	0.8–1.4	..	..
High job demands	1.33	1.1–1.6	1.24	1.0–1.6	..	..
Effort–reward imbalance	2.57	1.8–3.6	1.67	1.0–2.9	..	..
Low work social support	1.31	1.2–1.5	1.17	1.0–1.4	..	..
<i>Shields, 1999 Canada (77)</i>						
Depressive episode						
Long hours	0.6	0.3–1.3	2.2	1.1–4.4	..	..
Job strain	3.3	1.3–8.5	2.1	1.1–4.0	..	..
<i>Bultmann et al, 2002 Netherlands (35)</i>						
Psychological distress						
Psychological demands	1.51	1.23–1.85	1.44	1.03–2.01	..	..
Decision latitude	1.14	0.90–1.43	0.88	0.62–1.24	..	..
Co-worker social support	1.25	1.04–1.49	1.31	0.97–1.78	..	..
Supervisor social support	1.25	1.05–1.49	1.12	0.85–1.47	..	..
Emotional demands	1.73	1.40–2.14	1.39	1.01–1.91	..	..
Conflicts supervisor	1.75	1.34–2.30	0.99	0.53–1.83	..	..
Job insecurity	1.63	1.18–2.27	0.94	0.56–1.59	..	..
<i>Griffin et al, 2002 United Kingdom (75)</i>						
Anxiety						
Decision latitude	1.43	1.15–1.79	1.20	0.86–1.67	..	..
Home control	1.68	1.25–2.24	1.48	0.88–2.48	..	..
Depression						
Decision latitude	1.15	0.92–1.44	1.15	0.81–1.64	..	..
Work grade						
High						
Decision latitude	1.29	1.03–1.62	1.12	0.44–2.87	..	..
Home control	1.71	1.28–2.29	1.81	0.76–4.28	..	..
Middle						
Decision latitude	1.76	1.39–2.23	1.60	1.16–2.21	..	..
Home control	2.22	1.63–3.03	1.82	1.05–3.14	..	..
Low						
Decision latitude	1.42	0.42–4.79	1.27	0.81–1.97	..	..
Home control	2.03	0.92–4.47	4.41	2.44–7.97	..	..

(continued)

Table 2. Continued.

Study	Results					
	Men		Women		All	
	Odds ratio	95% CI	Odds ratio ^a	95% CI	Odds ratio ^a	95% CI
<i>Kivimäki et al, 2003 (71); Ylipaavalniemi et al, 2005 Finland (76)</i>						
Psychological distress (2003)						
Low procedural justice	..	..	..	..	1.30	1.08–1.56
Low relational justice	..	..	..	..	1.00	0.83–1.19
Low decision authority	..	..	..	..	1.20	1.00–1.44
High workload	..	..	..	..	1.60	1.32–1.92
Depression (2005)						
Low job control	..	..	..	..	1.01	0.70–1.46
High job demand	..	..	..	..	1.13	0.80–1.58
High job strain	..	..	..	..	1.27	0.92–1.76
Low team climate	..	..	..	..	1.55	1.07–2.22
<i>Wang et al, 2004 (73)</i>						
Major depressive episode						
Skill discretion	..	..	..	..	1.24	1.04–1.48
Decision authority	..	..	..	..	1.04	0.86–1.27
Physical exertion	..	..	..	..	1.08	0.91–1.29
Psychological demands	..	..	..	..	1.33	1.11–1.63
Job insecurity	..	..	..	..	1.31	1.09–1.56
Social support	..	..	..	..	1.31	1.10–1.55
<i>Godin et al, 2005 (78)</i>						
Common mental disorders						
Effort–reward imbalance baseline only						
Depression	1.2	0.5–2.9	1.3	0.5–3.2	..	..
Anxiety	0.8	0.3–2.1	1.1	0.4–3.1	..	..
Somatization	1.5	0.7–3.4	1.6	0.5–4.5	..	..
Chronic fatigue	1.4	0.7–3.1	1.2	0.5–3.1	..	..
Psychotropic drugs ^b	1.5	0.6–4.1	1.0	0.3–3.0	..	..
Effort–reward imbalance at baseline and follow-up						
Depression	2.8	1.3–5.7	4.6	2.3–9.0	..	..
Anxiety	2.3	1.1–4.8	4.5	2.1–9.8	..	..
Somatization	2.0	0.9–4.4	3.6	1.6–8.2	..	..
Chronic fatigue	1.8	0.9–3.6	7.1	3.4–14.5	..	..
Psychotropic drugs	3.4	1.5–7.7	1.4	0.5–3.5	..	..
Effort–reward imbalance follow-up only						
Depression	4.6	2.3–9.2	3.2	1.6–6.4	..	..
Anxiety	3.7	1.7–7.8	2.3	1.1–4.8	..	..
Somatization	4.1	2.0–8.5	3.5	1.7–7.2	..	..
Chronic fatigue	3.4	1.7–6.7	2.0	0.9–4.1	..	..
Psychotropic drugs	3.2	1.5–7.0	2.7	1.3–5.6	..	..
<i>Marchand et al, 2005 (61)</i>						
Psychological distress						
Skill utilization	..	..	..	..	1.02	0.98–1.07
Decision authority	..	..	..	..	1.08	1.03–1.13
Psychological demands	..	..	..	..	1.04	0.99–1.10
Job insecurity	..	..	..	..	1.31	1.07–1.61
Social support	..	..	..	..	0.96	0.92–1.01

^a Regression model fully adjusted unless stated otherwise. Risk in lowest group compared with highest group unless stated otherwise.

^b Scale summarizing type and frequency of psychotropic drug use in the last 4 weeks.