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# Psychosocial Stressors at Work and the Risk of Sickness Absence Due to a Diagnosed Mental Disorder
## A Systematic Review and Meta-analysis

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⊞ **Supplemental content**

**IMPORTANCE** Mental health problems are associated with considerable occupational, medical, social, and economic burdens. Psychosocial stressors at work have been associated with a higher risk of mental disorders, but the risk of sickness absence due to a diagnosed mental disorder, indicating a more severe condition, has never been investigated in a systematic review and meta-analysis.

**OBJECTIVE** To synthesize the evidence of the association of psychosocial stressors at work with sickness absence due to a diagnosed mental disorder among adult workers.

**DATA SOURCES** Seven electronic databases (MEDLINE, Embase, PsycInfo, Web of Science, CINAHL, Sociological Abstracts, and International Bibliography of the Social Sciences), 3 gray literature databases (Grey Literature Report, WHO-IRIS and Open Grey), and the reference lists of all eligible studies and reviews were searched in January 2017 and updated in February 2019.

**STUDY SELECTION** Only original prospective studies evaluating the association of at least 1 psychosocial stressor at work from the 3 most recognized theoretical models were eligible: the job demand-control-support model, including exposure to job strain (high psychological demands with low job control); effort-reward imbalance model; and organizational justice model. Study selection was performed in duplicate by blinded independent reviewers. Among the 28 467 citations screened, 23 studies were eligible for systematic review.

**DATA EXTRACTION AND SYNTHESIS** This meta-analysis followed the PRISMA and MOOSE guidelines. Data extraction and risk of bias evaluation, using the Risk of Bias in Nonrandomized Studies–Interventions tool, were performed in duplicate by blinded independent reviewers. Data were pooled using random-effect models.

**MAIN OUTCOMES AND MEASURES** Sickness absence due to a mental disorder with a diagnosis obtained objectively.

**RESULTS** A total of 13 studies representing 130 056 participants were included in the 6 meta-analyses. Workers exposed to low reward were associated with a higher risk of sickness absence due to a diagnosed mental disorder compared with nonexposed workers (pooled risk ratio [RR], 1.76 [95% CI, 1.49-2.08]), as were those exposed to effort-reward imbalance (pooled RR, 1.66 [95% CI, 1.37-2.00]), job strain (pooled RR, 1.47 [95% CI, 1.24-1.74]), low job control (pooled RR, 1.25 [95% CI, 1.02-1.53]), and high psychological demands (pooled RR, 1.23 [95% CI, 1.04-1.45]).

**CONCLUSIONS AND RELEVANCE** This meta-analysis found that workers exposed to psychosocial stressors at work were associated with a higher risk of sickness absence due to a mental disorder. A better understanding of the importance of these stressors could help physicians when evaluating their patients' mental health and work capacity.

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M ental disorders are a major cause of disability worldwide[1] and one of the leading reasons for physician visits in United States,[2] Canada,[3] and Europe.[4] Working adults are particularly at risk for mental disorders.[5,6] There is a significant association of mental disorders with work capacity and productivity,[5,7,8] and approximately 33% of workers with mental disorders will be prescribed sick leave.[9] Because of their high prevalence and recurrence, sickness absences (SAs) due to mental disorders are associated with considerable occupational, medical, social, and economic burdens.[10-13]

Although approxmately one-third of all absences from work certified by physicians are due to mental disorders, physicians have reported difficulties in assessing work capacity, particularly in the case of a mental disorder.[14,15] Limited evidence is available on work-related factors associated with SAs among individuals with common mental disorders.[16]

In recent systematic reviews,[17-19] exposure to adverse psychosocial stressors at work was associated with a higher risk of mental disorders. Psychosocial stressors at work are generally defined by 3 recognized theoretical models: the job demand-control-support (JDCS) model,[20] the effort-reward imbalance (ERI) model,[21] and the organizational justice model.[22] The JDCS model postulates that exposure to high psychological demands combined with low job control causes a high stress condition, known as job strain, that can lead to health problems.[20] A third component, low social support at work, can amplify the adverse effect of job strain.[23] According to the ERI model, workers are in detrimental imbalance when high effort at work is combined with low reward, a state hypothesized to increase the risk of health issues.[21] Finally, the organizational justice model postulates that perceived injustice or unfairness in the rules and social norms that govern a company could have a negative effect on workers' health.[22] In industrialized countries, 20% to 25% of workers are exposed to these psychosocial stressors at work.[24]

There is cumulative evidence of the adverse association of these psychosocial stressors at work with the risk of mental disorders.[17-19] The association of these stressors with the risk of SA due to a diagnosed mental disorder,[25-33] an objective measure indicating a more severe condition, has never been investigated in a systematic review and meta-analysis, to our knowledge. A better understanding of the association of psychosocial stressors at work with mental disorders could help physicians when evaluating their patients' mental health and work capacity.

This systematic review and meta-analysis aimed to synthetize and evaluate the prospective evidence of the association of psychosocial stressors at work from the JDCS, ERI and organizational justice models with the risk of SA due to a diagnosed mental disorder among adult workers.

## Methods

### Specific Considerations

This review follows the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline[34] and the Meta-analysis of Observational Studies in Epidemiology

### Key Points

**Question** Do psychosocial stressors at work increase the risk of sickness absence due to a diagnosed mental disorder?

**Findings** In this systematic review and meta-analysis, psychosocial stressors at work were associated with an elevated risk of sickness absence due to a diagnosed mental disorder. The risk was up to 76% higher among workers exposed to these work stressors compared with nonexposed workers.

**Meaning** Given that psychosocial stressors at work are frequent and modifiable, physicians should be aware of their importance when evaluating their patients' mental health and work capacity.

(MOOSE) reporting guideline.[35] The protocol was registered in PROSPERO (No. CRD42018091632) and published in 2018.[36] The search strategy was created to conduct a broader systematic review of the association of psychosocial stressors at work with all mental disorders. The present review focuses on the association of these stressors with SA due to a diagnosed mental disorder. The association with depression and antidepressive medication use will be presented elsewhere (PROSPERO; No. CRD42018107666).

### Eligibility Criteria

#### Study Design

Only original prospective studies that evaluated the association of at least 1 psychosocial stressor at work from the JDCS, ERI, or organizational justice models with SA due to a diagnosed mental disorder were included. Cross-sectional, qualitative, and case-control studies were excluded.

#### Population

The population of interest comprised working adults. Studies including only ill participants (eg, return-to-work or absence recurrence studies) were excluded to avoid reverse causality.[37] For a comparison group to be eligible, the nonexposed group had to be from the same study population as the exposed group.

#### Exposure

Exposure to adverse psychosocial stressors at work from the JDCS, ERI, and organizational justice models were considered. These stressors include high psychological demands, low job control, low social support at work, high effort, low reward, and poor procedural, distributive, or relational justice. Combinations of these stressors from the 3 theoretical models were also considered: exposure to job strain, effort-reward imbalance, and low organizational justice. Only studies that measured these psychosocial stressors at work using validated tools or a proxy of validated tools (ie, translation) were included.

#### Outcome

The outcome of interest was SA due to a mental disorder with a medical diagnosis delivered by a physician. This outcome includes absences of different lengths (generally from 1 to 90

days) and disability pension, which is an absence of longer duration, generally more than 1 year. Data on the SA and the mental disorder diagnosis must have been obtained objectively (ie, from registers or physicians). Studies using self-reported work absences or mental disorders were excluded.

### Information Sources

Seven electronic databases were consulted: MEDLINE (all Ovid and MEDLINE databases, from 1946 to present), Embase, PsycInfo (Ovid), Web of Science, CINAHL (EBSCOhost), Sociological Abstracts, and International Bibliography of the Social Sciences. The reference lists of all eligible studies and all relevant reviews (systematic or narrative) were also consulted. Furthermore, 3 gray literature databases were consulted: Grey Literature Report, WHO-IRIS, and Open Grey. The complete search strategy was first performed in January 2017 and updated in October 2017. Another update was conducted in February 2019 for the 3 most important databases (MEDLINE, Embase, and PsycInfo).

### Search Strategy

The search strategy combined 4 sets of keywords adapted to each database. First, terms that refer to (1) population (workers), (2) exposure (psychosocial stressors at work), and (3) outcome (all mental disorders) were combined in 1 group. Second, concepts that referred to (4) both population and exposure (eg, work stress) were combined with the outcome terms in another group. Finally, these 2 groups were merged to obtain a pool of unique citations. The complete search strategy is available in eAppendix 1 in the Supplement.

### Selection Process

All citations and abstracts were extracted from the databases, and duplicates were removed. All titles and abstracts were screened by 2 trained blinded independent reviewers (C.S.D. and K.A.) and classified into 4 groups: (1) yes: all eligibility criteria were clearly met; (2) maybe: eligibility criteria cannot be evaluated without consulting the full text; (3) no: at least 1 of the eligibility criteria was clearly not met; and (4) review: all nonoriginal papers related to the association of psychosocial stressors at work with mental disorders (ie, systematic and narrative reviews, book chapters, and commentaries). This latter group (ie, the review group) was used to screen the reference lists. All studies classified in 1 of the 2 relevant groups (the yes and maybe groups) by at least 1 of the reviewers were retained for full-text screening. All retained full texts were screened in duplicate by 5 blinded independent reviewers (C.S.D., K.A., R.N., V.M., and A.-P.B.P.-G.). Each reviewer had full texts in common with each of the other reviewers. Disagreements were resolved by consensus between the reviewers or by consultation with the principal investigator (C.B.). For articles written in languages other than English or French, we used Google Translate (https://translate.google.com/) for a first screening according to title and abstract only when an English abstract was not available (n = 19). During full-text screening, we used Google Translate to translate the Methods section of the article to assess whether the article met the eligibility criteria, such as the study design and assessment of the outcome (n = 98). If the article appeared to fulfill the eligibility criteria, or if any doubt remained, the text was translated by a professional translator, and the study authors were contacted to ensure that the translation was correct (n = 1).

### Data Collection

Data extraction was performed in duplicate by 2 trained and blinded independent reviewers (C.S.D. and A.-P.B.P.-G.) with the use of a standardized extraction grid. Data items (including detailed information on the population, study design, exposure, outcomes, analyses, covariates, and results) are synthesized in eTable 1 in the Supplement.

### Quality Evaluation and Risk of Bias

The risk of bias for each included study was evaluated in duplicate, using the recommended[38] Risk of Bias in Non-Randomized Studies-Interventions (ROBINS-I)[39] tool, by 2 trained and blinded independent reviewers (C.S.D. and M.L.-R.) and by consultation with the principal investigator (C.B.) and a biostatistician (D.T.). In the ROBINS-I tool, risks of bias are classified as low, moderate, serious, or critical. According to the ROBINS-I tool, the best classification for the risk of confounding bias is moderate, given the potential for confounding inherent in observational studies. The ROBINS-I tool was slightly adapted to our research field after consensus was reached between researchers (C.S.D., D.T., M.L.-R., D.L., and C.B.) (eAppendix 2 in the Supplement). For example, we decided that the best classification for the risk of bias in selection of the participants into the study would be set at moderate because of the potential of bias introduced by the healthy worker effect in occupational studies.[40,41]

### Meta-analysis

Meta-estimates using random-effect models were calculated for each psychosocial stressor at work using Review Manager (RevMan) software, version 5.3 (Cochrane Community). To reduce the source of heterogeneity and the potential for misclassification with an aggregated measure of exposure, studies that used only work-unit or organizational-level measures (n = 2)[42,43] of psychosocial stressors at work were excluded from the meta-analyses. When a study used both measures,[28,29,44] the results of the individual-level measures were used in the meta-analyses. Effort and psychological demands were combined into 1 measure, given the similarity between these 2 stressors. We used estimates adjusted for the potential confounders identified from the quality evaluation criteria: age, sex, and socioeconomic status. When these adjusted estimates were not provided, we chose the model that included most of these confounders. Hazard ratios, odds ratios, and Poisson rate ratios were transformed into risk ratios (RRs).[45] Between-study heterogeneity was tested using the $I^2$ statistic, and the risk of publication bias was verified with funnel plot graphs for the 3 meta-analyses that included the most studies (n ≥7). Sensitivity analyses were conducted to explore the sources of heterogeneity and the association of studies with lower methodological quality.

## Results

A total of 28 467 citations were screened based on title and abstract (**Figure 1**; eFigure 1 in the Supplement). After the exclusion of studies that did not meet inclusion criteria, 3627 studies were retained for full-text screening. Overall, 26 studies met the eligibility criteria. Of these, 3 studies[46-48] were excluded because they were duplicate analyses of already included studies.[26,28,29,43,49] Finally, 23 studies were included in the present systematic review.[25-33,42-44,49-59]

Most of the study populations originated from European countries[26-32,42-44,49,50,52,53,56,58] or Canada,[25,33,54,55,57] and 2 were from Japan[51,59] (eTable 1 in the Supplement). Study populations included many occupation types: blue-collar and white-collar workers,[25,26,28,29,31,33,44,50,56,57] health care workers,[32,52-55,58] manufacturing workers,[43,51] distribution and transportation workers,[30] and information technology workers,[59] as well as population-based samples.[27,42,49] Follow-up ranged from 6 months to 12 years. The minimum number of days a worker had to be absent from work to be considered as a case varied between studies: 1 to 5 days (n = 6),[25,33,43,54,55,57] 6 to 10 days (n = 5),[27,44,52,56,59] 15 to 30 days (n = 4),[31,32,49,51] 42 to 90 days (n = 3),[30,53,58] or 1 year or 300 days during 2 consecutive years (n = 5).[26,28,29,42,50] All mental disorder diagnoses were issued or validated by a physician.

Most studies used Cox proportional hazards regression, logistic regression, or Poisson regression models. However, 1 study used probit regression,[52] and 1 study used a Pearson correlation[53]; these 2 studies could not be included in the meta-analyses.

Results of the risk-of-bias evaluation using the ROBINS-I tool are presented in the **Table**[25-33,42-44,49-59] and are detailed in eAppendix 3 in the Supplement. Thirteen studies showed the best classification (moderate) for the risk of bias due to confounding.[25,26,28,30,32,42-44,50,52,54-56] Two studies presented a critical risk of bias because no confounding adjustment was performed.[53,58] Nine studies presented the best classification (moderate) for the risk of bias in the selection of the participants into the study.[25,26,30,33,42,43,51,54,59] Three studies were at critical risk of selection bias at the beginning of the study because of their very low participation rates at baseline (30%-48%).[31,32,49] Seven studies presented a low risk of bias in the classification of exposure because they used validated tools to measure psychosocial stressors at work at the individual level and excluded prevalent cases from the analyses.[25,27,30,33,51,53,58] Four studies that had not provided a reference for the validation of the tool used to measure exposure or had only used an organizational-level measure of the exposure, which is prone to misclassification bias, were classified at serious risk.[29,42,43,52] Concerning bias due to missing data, 6 studies were at low risk of bias,[28,33,42,43,52,55] 7 were at moderate risk,[25,31,49,51,53,56,59] and 9 were at serious risk of bias.[26,27,29,30,32,44,50,54,57] All studies except one[58] presented a low risk of bias in the measurement of the outcome. As recommended,[39,60] 5 studies with a critical risk of bias in at least 1 area[31,32,49,53,58] were not included in the meta-analyses.

Figure 1. Flowchart for the Selection of the Included Studies
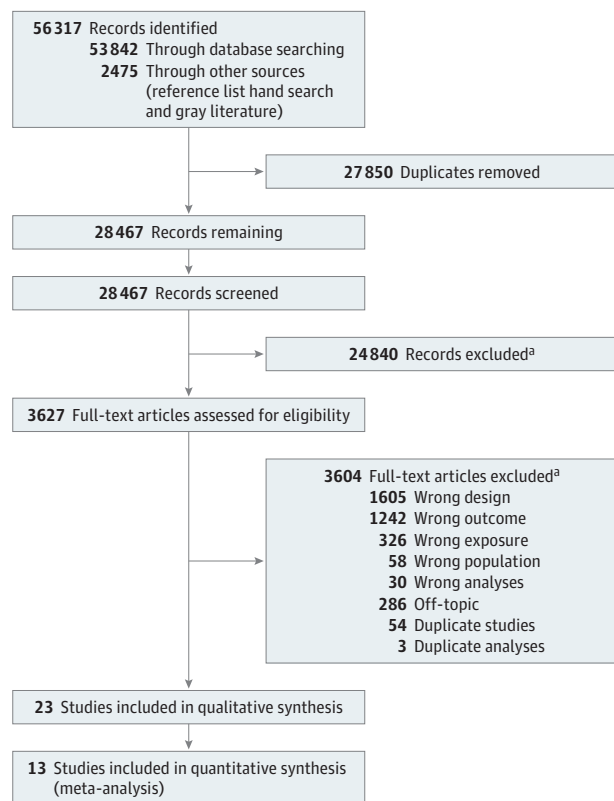


a Wrong study design: cross-sectional studies, ecological studies, intervention studies, case-control studies with a retrospective design, qualitative or case studies, and not original studies; wrong outcome: all-cause absence, self-reported absence or reason for absence, mental health not evaluated, nonvalidated measure of mental health, or off topic; wrong exposure: psychosocial stressors at work from at least 1 of the 3 considered models were not measured or were measured with a nonvalidated tool; wrong population: population of patients or of workers on sick leave, pregnant women, or in a process of returning to work; and wrong analyses: association between psychosocial stressors at work and mental health not reported (not an objective of the study).

After the exclusion of studies that used only work-unit or organizational-level exposures,[42,43] probit regression,[52] or Pearson correlation[53] and of studies with a critical risk of bias,[31,32,49,53,58] 13 studies representing 130 056 participants were included in the meta-analyses (**Figure 2** and **Figure 3**). Workers exposed to low reward (3 studies; 38 659 participants)[25,29,54] were at highest risk of SA due to a mental disorder (pooled RR, 1.76 [95% CI, 1.49-2.08]), as were those exposed to effort-reward imbalance (pooled RR, 1.66 [95% CI, 1.37-2.00]; 3 studies; 38 659 participants),[25,29,54] job strain (pooled RR, 1.47 [95% CI, 1.24-1.74]; 8 studies; 81 284 participants),[27,28,33,51,54,55,57,59] low job control (pooled RR, 1.25 [95% CI, 1.02-1.53]; 5 studies; 37 606 participants),[27,30,50,51,54] and high psychological demands (pooled RR, 1.23 [95% CI, 1.04-1.45]; 7 studies; 74 951 participants).[25,27,29,30,50,51,54] An association was also observed for low social support at work (9 studies; 47 140 participants),[27,30,50,51,54-57,59] but this association was not statistically significant (RR, 1.12 [95% CI, 0.99-1.26]). Depending on the psychosocial stressor at work studied,

Table. Quality Evaluation of Prospective Studies on Psychosocial Stressors at Work and Sickness Absence Due to a Diagnosed Mental Disorder, According to ROBINS-I Criteria

| Source | Risk of bias | | | | |
| --- | --- | --- | --- | --- | --- |
| | Due to confounding[a] | Selection of participants into the study[a] | Classification of exposure | Due to missing data | Measurement of outcomes |
| Roelen et al,[32] 2018 | Moderate | Critical | Moderate | Serious | Low |
| Vendrig et al,[58] 2018 | Critical | No information | Low | No information | Moderate |
| van Hoffen et al,[30] 2018 | Moderate | Moderate | Low | Serious | Low |
| Ndjaboué et al,[33] 2017 | Serious | Moderate | Low | Low | Low |
| Ohta et al,[59] 2017 | Serious | Moderate | Moderate | Moderate | Low |
| Juvani et al,[26] 2016 | Moderate | Serious | Moderate | Serious | Low |
| Mather et al,[27] 2015 | Serious | Serious | Low | Serious | Low |
| Janssens et al,[31] 2014 | Serious | Critical | Moderate | Moderate | Low |
| Juvani et al,[29] 2014[b] | Serious | Serious | Serious | Serious | Low |
| Ndjaboué et al,[25] 2014 | Moderate | Moderate | Low | Moderate | Low |
| Elovainio et al,[44] 2013 | Moderate | Serious | Moderate | Serious | Low |
| Samuelsson et al,[42] 2013 | Moderate | Moderate | Serious | Low | Low |
| Lahelma et al,[50] 2012 | Moderate | Serious | Moderate | Serious | Low |
| Mäntyniemi et al,[28] 2012[b] | Moderate | Serious | Serious | Low | Low |
| Inoue et al,[51] 2010 | Serious | Moderate | Low | Moderate | Low |
| Kivimäki et al,[52] 2010 | Moderate | Serious | Serious | Low | Low |
| Clumeck et al,[49] 2009 | Serious | Critical | Moderate | Moderate | Low |
| Wännström et al,[53] 2009 | Critical | Serious | Low | Moderate | Low |
| Bourbonnais et al,[54] 2005 | Moderate | Moderate | Moderate | Serious | Low |
| Boedeker,[43] 2001 | Moderate | Moderate | Serious | Low | Low |
| Bourbonnais et al,[55] 2001 | Serious | Serious | Moderate | Low | Low |
| Stansfeld et al,[56] 1997 | Moderate | Serious | Moderate | Moderate | Low |
| Bourbonnais et al,[57] 1995 | Serious | Serious | Moderate | Serious | Low |

Abbreviation: ROBINS-I, Risk of Bias in Nonrandomized Studies-Intervention Tool.

[a] Low level was not possible for these risk-of-bias criteria.

[b] Quality evaluation for the individual-level analyses.

heterogeneity was low ($I^2 = 0\%$ for reward and $I^2 = 34\%$ for effort-reward imbalance) or moderately high ($I^2 = 45\%$ for social support, $I^2 = 56\%$ for psychological demands, $I^2 = 58\%$ for job strain, and $I^2 = 72\%$ for job control).

Sensitivity analyses with the inclusion of studies using work-unit or organizational-level exposures showed similar results but increased the heterogeneity ($I^2 = 65\%$-93%) (eTable 2 in the Supplement). Other sensitivity analyses were all similar to the main results, (1) including studies using hazard ratios only, (2) including studies using job strain categorized in quadrants only, (3) including studies using job content questionnaire only, (4) including the results from coworker support instead of supervisor support for studies that have these results stratified by the 2 types of

support, (5) excluding studies in which the prevalent cases were not clearly excluded at baseline, (6) excluding studies with disability pension, or (7) including studies with a critical risk of bias.

Not enough studies using the organizational justice models were available to calculate a meta-estimate. The results presented in eTable 1 in the Supplement show protective associations of good relational, procedural, and organizational justice (hazard ratios, 0.69-0.79).[26,44]
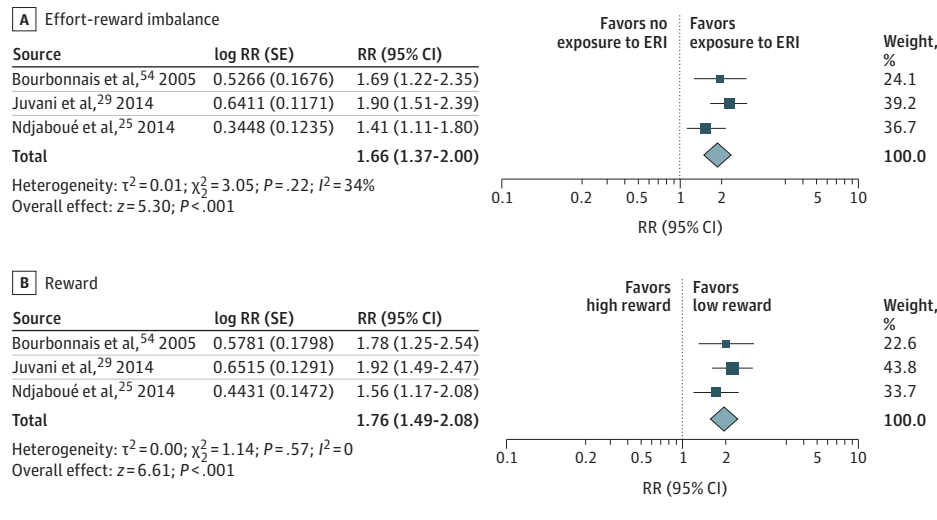
No indication of publication bias was found in the funnel plots for job strain, psychological demands, or social support (eFigure 2 in the Supplement). Not enough studies were available to evaluate the potential of publication bias for the other psychosocial stressors at work.

## Figure 2. Psychosocial Stressors at Work From the Job-Demand-Control-Support Model and the Risk of Sickness Absence Owing to a Diagnosed Mental Disorder
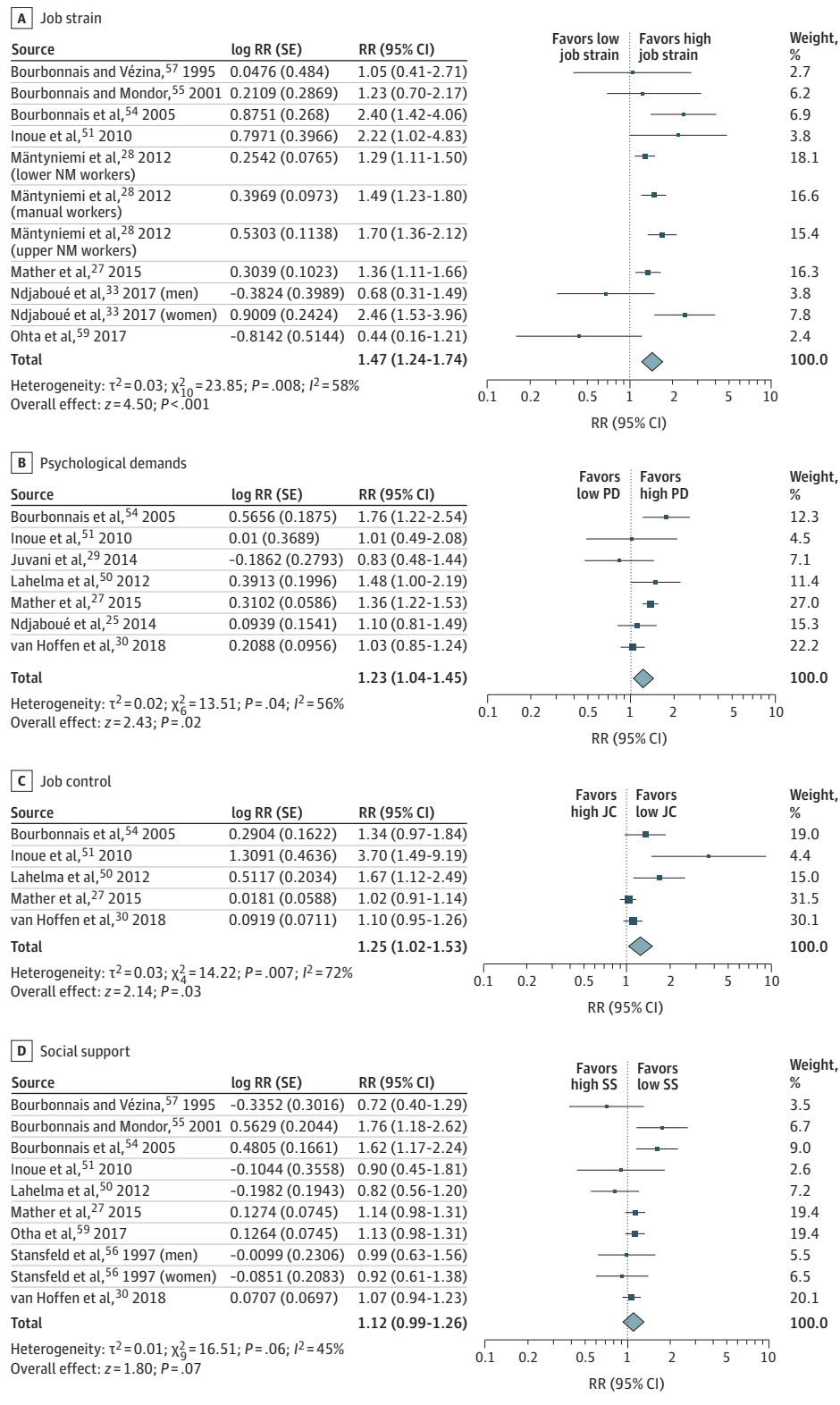


A, Job strain. B, Psychological demands (PDs). C, Job control (JC). D, Social support (SS). The data marker sizes are proportional to the weight of the studies included in the meta-analysis.

Figure 3. Association of Psychosocial Stressors at Work From the Effort-Reward Imbalance (ERI) Model
With the Risk of Sickness Absence Owing to a Diagnosed Mental Disorder



A  Effort-reward imbalance

| Source | log RR (SE) | RR (95% CI) | | Weight, % |
|---|---|---|---|---|
| Bourbonnais et al,[54] 2005 | 0.5266 (0.1676) | 1.69 (1.22-2.35) | | 24.1 |
| Juvani et al,[29] 2014 | 0.6411 (0.1171) | 1.90 (1.51-2.39) | | 39.2 |
| Ndjaboué et al,[25] 2014 | 0.3448 (0.1235) | 1.41 (1.11-1.80) | | 36.7 |
| Total | | 1.66 (1.37-2.00) | | 100.0 |

Heterogeneity: $\tau^2 = 0.01$; $\chi_2^2 = 3.05$; $P = .22$; $I^2 = 34\%$
Overall effect: $z = 5.30$; $P < .001$

B  Reward

| Source | log RR (SE) | RR (95% CI) | | Weight, % |
|---|---|---|---|---|
| Bourbonnais et al,[54] 2005 | 0.5781 (0.1798) | 1.78 (1.25-2.54) | | 22.6 |
| Juvani et al,[29] 2014 | 0.6515 (0.1291) | 1.92 (1.49-2.47) | | 43.8 |
| Ndjaboué et al,[25] 2014 | 0.4431 (0.1472) | 1.56 (1.17-2.08) | | 33.7 |
| Total | | 1.76 (1.49-2.08) | | 100.0 |

Heterogeneity: $\tau^2 = 0.00$; $\chi_2^2 = 1.14$; $P = .57$; $I^2 = 0$
Overall effect: $z = 6.61$; $P < .001$

A, Effort-reward imbalance;
B, Reward. The data markers sizes are
proportional to the weight of the
studies included in the meta-analysis.

## Discussion

This systematic review and meta-analysis found that exposure to psychosocial stressors at work was associated with an increased risk of SA due to a diagnosed mental disorder. Exposure to job strain was associated with a 47% increased risk of SA. The risk of SA was also 66% higher for those exposed to effort-reward imbalance. A similar increased risk was observed for low reward (76%), which could suggest that this stressor plays an important role in the adverse effect of effort-reward imbalance. Elevated risks, but of a smaller magnitude, were also observed for low job control (25%), high psychological demands (23%) and low social support at work (12%).

These results are in line with those of previous systematic reviews on the risk of various mental disorders[17-19] or SA due to various psychosocial health conditions.[61] In contrast to most of these reviews,[17,18,61] the present meta-analysis was based solely on objectively measured mental disorders (physician-confirmed diagnosis), thus limiting the risk of common method bias. Moreover, these results provide new information, to our knowledge, on the association of these work stressors with more severe mental disorders that lead to SAs, which could be of very long duration (≤300 days).

The evaluation of the risk of bias using the ROBINS-I tool highlights some bias and methodological issues that are inherent and/or common in occupational research. First, the healthy worker effect in occupational studies may introduce a selection bias.[40,41] Workers who are highly exposed to psychosocial stressors at work may quit their job because of this exposure, before their health condition sufficiently deteriorates to lead to SAs. Previous studies demonstrate that, when present, the healthy worker effect is generally associated with an underestimation of the true effect.[41] Thus, the healthy worker effect is unlikely to explain the associations observed in the present meta-analyses.

Second, the low participation rate at baseline and the high proportion of participants lost to follow-up and missing data found in some studies are associatedd with an increased risk of selection bias. However, we excluded the 3 studies with a critical risk of bias due to low participation rates at baseline (30%-48%).[31,32,49] All the included studies had a participation rate of 60% or higher, and 8 of 13 studies had a participation rate of 70% or higher. Given that more-exposed and less-healthy workers are more likely to refuse to participate and are more likely to be lost to follow-up, this selection bias, if present, will tend to underestimate the true association and thus, is unlikely to explain the associations observed.[40,41] In future studies, statistical methods (such as inverse probability weighting of being selected or multiple imputation) could be used, at least as sensitivity analyses, to address these methodological limitations.[41,62] Finally, the exclusion of prevalent cases at baseline was not always done or clearly stated in the articles.[31,32,43,49,54,55,59] The presence of a mental disorder or a history of mental disorder at baseline could potentially be associated with participants' responses to the self-reported questionnaires and with an increased risk of reverse causality. These participants may perceive their work conditions more negatively than those without a mental disorder or without a history of mental disorder at baseline, which could overestimate the association.[37] However, sensitivity analyses that excluded studies that did not report excluding prevalent cases at baseline showed similar results to the main analyses (eTable 2 in the Supplement). Furthermore, about half of the studies included in the meta-analyses controlled for depressive symptoms at baseline[28-30,51,56,59] and/or for a history of mental disorders or SAs.[27,28,54,56] Thus, if present, the effect of reverse causation should be of a small magnitude. A recent study using life-course data found that the association between job strain and common mental disorders was independent of psychiatric morbidity at 2 earlier points in the individual's life and of other early life factors,[37] suggesting that this association could not be explained by reverse causation.

Despite the fact that no restrictions on geography or language were made in our eligibility criteria, most of the included studies were from high-income European countries and from Canada. This could partly be due to the fact that these countries have public health policies that include national health care coverage, thus facilitating data access to conduct such studies. Caution should therefore be exercised in the generalization of these results to other countries. Finally, an evaluation of sex differences was not possible because not enough studies conducted analyses separately by sex (n = 6).[25,26,33,49,56,57]

### Strengths and Limitations

This systematic review has several strengths, including a rigorous selection process following PRISMA and MOOSE guidelines, the consultation of several databases (including gray literature), no restriction on geography or language, and no indication of publication bias. Moreover, to our knowledge, this is the first systematic review in the field of occupational health research that made an in-depth evaluation of the risk of bias using the ROBINS-I tool, as recommended.[38] Finally, the results were robust to several sensitivity analyses.

This systematic review also has some limitations. Our initial search ended in January 2017. However, we conducted an update of the search strategy for the 3 principal databases (MEDLINE, Embase, and PsycInfo) in Feburary 2019. Because these 3 databases are the most appropriate ones for this topic, it is unlikely that relevant studies published during these last 2 years were missed by our updated search. Between-study heterogeneity was moderately high in some meta-analyses, indicating that studies might show some differ-

ences in their characteristics that could limit the use of a meta-analysis. However, the exploration of this heterogeneity in sensitivity analyses did not reveal major differences in the pooled estimates. Finally, the quality evaluation of the included studies identified some risk of selection bias. However, this bias is most likely to result in an underestimation of the true association and thus, if present, would not change the conclusion of the meta-analyses.

## Conclusions

The results of this systematic review and meta-analysis provide new knowledge showing that psychosocial stressors at work are associated with an increased risk of SA due to a diagnosed mental disorder. These results reinforce the strength of previous evidence showing that workers exposed to psychosocial stressors at work are at a higher risk of mental disorders. A better understanding of the association of these stressors with the risk of SA could help physicians when evaluating their patients' mental health and work capacity. Considering the high social and economic burdens associated with SAs, disability, and mental disorders in general, these results are also of great importance for public health. Psychosocial stressors at work are frequent[24] and modifiable.[63] Thus, efforts should be made by employers and public health decision makers, with the support of physicians, to develop organizational policies supporting workplaces in reducing these psychosocial stressors at work and, therefore, reducing the risk of mental disorders among workers.

### REFERENCES

**1**. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017; 390(10100):1211-1259. doi:10.1016/S0140-6736(17) 32154-2

**2**. St Sauver JL, Warner DO, Yawn BP, et al. Why patients visit their doctors: assessing the most prevalent conditions in a defined American population. *Mayo Clin Proc*. 2013;88(1):56-67. doi: 10.1016/j.mayocp.2012.08.020

**3**. IMS Health Canada. Disease dynamics in 2009; insight and outlook from IMS Health. Published 2010. Accessed September 26, 2019. http:// stacommunications.com/journals/cpm/2010/04-April-2010/04CPM_035.pdf

**4**. World Health Organization. Depression in Europe. Published October 10, 2012. Accessed September 26, 2019. http://www.euro.who.int/en/ health-topics/noncommunicable-diseases/ mental-health/news/news/2012/10/depression-in-europe

**5**. Henderson M, Harvey SB, Overland S, Mykletun A, Hotopf M. Work and common psychiatric disorders. *J R Soc Med*. 2011;104(5):198-207. doi:10. 1258/jrsm.2011.100231

6. Gjesdal S, Holmaas TH, Monstad K, Hetlevik Ø. GP consultations for common mental disorders and subsequent sickness certification: register-based study of the employed population in Norway. *Fam Pract*. 2016;33(6):656-662. doi:10.1093/fampra/cmw072

7. Adler DA, McLaughlin TJ, Rogers WH, Chang H, Lapitsky L, Lerner D. Job performance deficits due to depression. *Am J Psychiatry*. 2006;163(9):1569-1576. doi:10.1176/ajp.2006.163.9.1569

8. Burton WN, Pransky G, Conti DJ, Chen CY, Edington DW. The association of medical conditions and presenteeism. *J Occup Environ Med*. 2004;46(6)(suppl):S38-S45. doi:10.1097/01.jom.0000126687.49652.44

9. Mallen CD, Wynne-Jones G, Dunn KM. Sickness certification for mental health problems: an analysis of a general practice consultation database. *Prim Health Care Res Dev*. 2011;12(2):179-182. doi:10.1017/S1463423610000472

10. Koopmans PC, Roelen CA, Groothoff JW. Sickness absence due to depressive symptoms. *Int Arch Occup Environ Health*. 2008;81(6):711-719. doi:10.1007/s00420-007-0243-7

11. Stewart WF, Ricci JA, Chee E, Hahn SR, Morganstein D. Cost of lost productive work time among US workers with depression. *JAMA*. 2003;289(23):3135-3144. doi:10.1001/jama.289.23.3135

12. Lim KL, Jacobs P, Ohinmaa A, Schopflocher D, Dewa CS. A new population-based measure of the economic burden of mental illness in Canada. *Chronic Dis Can*. 2008;28(3):92-98.

13. Koopmans PC, Bültmann U, Roelen CA, Hoedeman R, van der Klink JJ, Groothoff JW. Recurrence of sickness absence due to common mental disorders. *Int Arch Occup Environ Health*. 2011;84(2):193-201. doi:10.1007/s00420-010-0540-4

14. Bertilsson M, Maeland S, Löve J, Ahlborg G Jr, Werner EL, Hensing G. The capacity to work puzzle: a qualitative study of physicians' assessments for patients with common mental disorders. *BMC Fam Pract*. 2018;19(1):133. doi:10.1186/s12875-018-0815-5

15. Letrilliart L, Barrau A. Difficulties with the sickness certification process in general practice and possible solutions: a systematic review. *Eur J Gen Pract*. 2012;18(4):219-228. doi:10.3109/13814788.2012.727795

16. de Vries H, Fishta A, Weikert B, Rodriguez Sanchez A, Wegewitz U. Determinants of sickness absence and return to work among employees with common mental disorders: a scoping review. *J Occup Rehabil*. 2018;28(3):393-417. doi:10.1007/s10926-017-9730-1

17. Theorell T, Hammarström A, Aronsson G, et al. A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health*. 2015;15:738. doi:10.1186/s12889-015-1954-4

18. Rugulies R, Aust B, Madsen IE. Effort-reward imbalance at work and risk of depressive disorders: a systematic review and meta-analysis of prospective cohort studies. *Scand J Work Environ Health*. 2017;43(4):294-306. doi:10.5271/sjweh.3632

19. Madsen IEH, Nyberg ST, Magnusson Hanson LL, et al; IPD-Work Consortium. Job strain as a risk factor for clinical depression: systematic review and meta-analysis with additional individual participant data. *Psychol Med*. 2017;47(8):1342-1356. doi:10.1017/S003329171600355X

20. Karasek R. Job-demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q*. 1979;24:285-308. doi:10.2307/2392498

21. Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol*. 1996;1(1):27-41. doi:10.1037/1076-8998.1.1.27

22. Moorman R. Relationship between organizational justice and organizational citizenship behaviors: do fairness perceptions influence employee citizenship? *J Appl Psychol*. 1991;76:845-855. doi:10.1037/0021-9010.76.6.845

23. Johnson JV. Theoretical developments in psychosocial work environment research. *Int J Health Serv*. 1989;19(3):457-458. doi:10.2190/DHDH-WUA4-3P0B-XVT9

24. Brisson C, Aboa-Eboulé C, Leroux I, et al. Work-related psychosocial factors and heart disease. In: Alland R, Fisher J, eds. *Heart and Mind: The Practice of Cardiac Psychology*. American Psychological Association; 2012:269-286.

25. Ndjaboué R, Brisson C, Vézina M, Blanchette C, Bourbonnais R. Effort–reward imbalance and medically certified absence for mental health problems: a prospective study of white-collar workers. *Occup Environ Med*. 2014;71(1):40-47. doi:10.1136/oemed-2013-101375

26. Juvani A, Oksanen T, Virtanen M, et al. Organizational justice and disability pension from all-causes, depression and musculoskeletal diseases: a Finnish cohort study of public sector employees. *Scand J Work Environ Health*. 2016;42(5):395-404. doi:10.5271/sjweh.3582

27. Mather L, Bergström G, Blom V, Svedberg P. High job demands, job strain, and iso-strain are risk factors for sick leave due to mental disorders: a prospective Swedish twin study with a 5-year follow-up. *J Occup Environ Med*. 2015;57(8):858-865. doi:10.1097/JOM.0000000000000504

28. Mäntyniemi A, Oksanen T, Salo P, et al. Job strain and the risk of disability pension due to musculoskeletal disorders, depression or coronary heart disease: a prospective cohort study of 69,842 employees. *Occup Environ Med*. 2012;69(8):574-581. doi:10.1136/oemed-2011-100411

29. Juvani A, Oksanen T, Salo P, et al. Effort-reward imbalance as a risk factor for disability pension: the Finnish Public Sector Study. *Scand J Work Environ Health*. 2014;40(3):266-277. doi:10.5271/sjweh.3402

30. van Hoffen MFA, Roelen CAM, van Rhenen W, Schaufeli WB, Heymans MW, Twisk JWR. Psychosocial work characteristics and long-term sickness absence due to mental disorders. *J Ment Health*. Published online February 8, 2018. doi:10.1080/09638237.2018.1437603

31. Janssens H, Clays E, De Clercq B, et al. The relation between psychosocial risk factors and cause-specific long-term sickness absence. *Eur J Public Health*. 2014;24(3):428-433. doi:10.1093/eurpub/cku009

32. Roelen CAM, van Hoffen MFA, Waage S, et al. Psychosocial work environment and mental health-related long-term sickness absence among nurses. *Int Arch Occup Environ Health*. 2018;91(2):195-203. doi:10.1007/s00420-017-1268-1

33. Ndjaboué R, Brisson C, Talbot D, Vézina M. Combined exposure to adverse psychosocial work factors and medically certified absence for mental health problems: a 5-year prospective study.

*J Psychosom Res*. 2017;92:9-15. doi:10.1016/j.jpsychores.2016.11.003

34. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ*. 2009;339:b2700. doi:10.1136/bmj.b2700

35. Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting: Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. *JAMA*. 2000;283(15):2008-2012. doi:10.1001/jama.283.15.2008

36. Duchaine CS, Gilbert-Ouimet M, Aubé K, et al. Effect of psychosocial work factors on the risk of certified absences from work for a diagnosed mental health problem: a protocol of a systematic review and meta-analysis of prospective studies. *BMJ Open*. 2018;8(10):e025948. doi:10.1136/bmjopen-2018-025948

37. Harvey SB, Sellahewa DA, Wang MJ, et al. The role of job strain in understanding midlife common mental disorder: a national birth cohort study. *Lancet Psychiatry*. 2018;5(6):498-506. doi:10.1016/S2215-0366(18)30137-8

38. Huffman MD, Thomas LE. Tools for evaluating and improving causal inference: introducing *JAMA Cardiology* readers to the Risk of Bias in Nonrandomized Studies of Interventions (ROBINS-I) tool. *JAMA Cardiol*. 2018;3(10):907. doi:10.1001/jamacardio.2018.2270

39. Sterne JA, Hernán MA, Reeves BC, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ*. 2016;355:i4919. doi:10.1136/bmj.i4919

40. Pearce N, Checkoway H, Kriebel D. Bias in occupational epidemiology studies. *Occup Environ Med*. 2007;64(8):562-568. doi:10.1136/oem.2006.026690

41. Buckley JP, Keil AP, McGrath LJ, Edwards JK. Evolving methods for inference in the presence of healthy worker survivor bias. *Epidemiology*. 2015;26(2):204-212. doi:10.1097/EDE.0000000000000217

42. Samuelsson Å, Ropponen A, Alexanderson K, Svedberg P. Psychosocial working conditions, occupational groups, and risk of disability pension due to mental diagnoses: a cohort study of 43,000 Swedish twins. *Scand J Work Environ Health*. 2013;39(4):351-360. doi:10.5271/sjweh.3338

43. Boedeker W. Associations between workload and diseases rarely occurring in sickness absence data. *J Occup Environ Med*. 2001;43(12):1081-1088. doi:10.1097/00043764-200112000-00010

44. Elovainio M, Linna A, Virtanen M, et al. Perceived organizational justice as a predictor of long-term sickness absence due to diagnosed mental disorders: results from the prospective longitudinal Finnish Public Sector Study. *Soc Sci Med*. 2013;91:39-47. doi:10.1016/j.socscimed.2013.05.008

45. Shor E, Roelfs D, Vang ZM. The "Hispanic mortality paradox" revisited: meta-analysis and meta-regression of life-course differentials in Latin American and Caribbean immigrants' mortality. *Soc Sci Med*. 2017;186:20-33. doi:10.1016/j.socscimed.2017.05.049

46. Godin I, Kornitzer M, Clumeck N, Linkowski P, Valente F, Kittel F. Gender specificity in the

prediction of clinically diagnosed depression: results of a large cohort of Belgian workers. *Soc Psychiatry Psychiatr Epidemiol*. 2009;44(7):592-600. doi:10.1007/s00127-008-0465-3

47. Friedel H. Differential associations between high mental and psychic demands made by work and the inability-to-work spectrum. *Gesundheitswesen*. 2003;65(3):181-186. In German. doi:10.1055/s-2003-38611

48. Juvani A, la Oksanen T, Virtanen M, et al. Clustering of job strain, effort-reward imbalance, and organizational injustice and the risk of work disability: a cohort study. *Scand J Work Environ Health*. 2018;44(5):485-495. doi:10.5271/sjweh.3736

49. Clumeck N, Kempenaers C, Godin I, et al. Working conditions predict incidence of long-term spells of sick leave due to depression: results from the Belstress I prospective study. *J Epidemiol Community Health*. 2009;63(4):286-292. doi:10.1136/jech.2008.079384

50. Lahelma E, Laaksonen M, Lallukka T, et al. Working conditions as risk factors for disability retirement: a longitudinal register linkage study. *BMC Public Health*. 2012;12:309. doi:10.1186/1471-2458-12-309

51. Inoue A, Kawakami N, Haratani T, et al. Job stressors and long-term sick leave due to depressive disorders among Japanese male employees: findings from the Japan Work Stress and Health Cohort study. *J Epidemiol Community Health*. 2010;64(3):229-235. doi:10.1136/jech.2008.085548

52. Kivimäki M, Vahtera J, Kawachi I, et al. Psychosocial work environment as a risk factor for absence with a psychiatric diagnosis: an instrumental-variables analysis. *Am J Epidemiol*. 2010;172(2):167-172. doi:10.1093/aje/kwq094

53. Wännström I, Peterson U, Asberg M, Nygren A, Gustavsson JP. Psychometric properties of scales in the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS): confirmatory factor analysis and prediction of certified long-term sickness absence. *Scand J Psychol*. 2009;50(3):231-244. doi:10.1111/j.1467-9450.2008.00697.x

54. Bourbonnais R, Brisson C, Vézina M, Masse B, Blanchette C. Psychosocial work environment and certified sick leave among nurses during organizational changes and downsizing. *Ind Relat*. 2005;60(3):483-509.

55. Bourbonnais R, Mondor M. Job strain and sickness absence among nurses in the province of Québec. *Am J Ind Med*. 2001;39(2):194-202. doi:10.1002/1097-0274(200102)39:2<194::AID-AJIM1006>3.0.CO;2-K

56. Stansfeld SA, Rael EG, Head J, Shipley M, Marmot M. Social support and psychiatric sickness absence: a prospective study of British civil servants. *Psychol Med*. 1997;27(1):35-48. doi:10.1017/S0033291796004254

57. Bourbonnais R, Vézina M. Mental health of white collar workers and the psychosocial environment at work. *Sante Ment Que*. 1995;20(2):163-184. In French. doi:10.7202/032358ar

58. Vendrig AA, Schaafsma FG. Reliability and validity of the Work and Well-Being Inventory (WBI)

for employees. *J Occup Rehabil*. 2018;28(2):377-390. doi:10.1007/s10926-017-9729-7

59. Ohta M, Higuchi Y, Kumashiro M, Yamato H, Sugimura H. Decrease in Work Ability Index and sickness absence during the following year: a two-year follow-up study. *Int Arch Occup Environ Health*. 2017;90(8):883-894. doi:10.1007/s00420-017-1251-x

60. McGuinness LA, Higgins JPT, Sterne JAC. Assessing the credibility of findings from nonrandomized studies of interventions. *JAMA Cardiol*. 2018;3(10):905-906. doi:10.1001/jamacardio.2018.2267

61. Duijts SF, Kant I, Swaen GM, van den Brandt PA, Zeegers MP. A meta-analysis of observational studies identifies predictors of sickness absence. *J Clin Epidemiol*. 2007;60(11):1105-1115. doi:10.1016/j.jclinepi.2007.04.008

62. Naimi AI, Richardson DB, Cole SR. Causal inference in occupational epidemiology: accounting for the healthy worker effect by using structural nested models. *Am J Epidemiol*. 2013;178(12):1681-1686. doi:10.1093/aje/kwt215

63. Brisson C, Gilbert-Ouimet M, Duchaine CS, Trudel X, Vézina M. Workplace interventions aiming to improve psychosocial work factors and related health. In: Siegrist J, Wahrendorf M, eds. *Work Stress and Health in a Globalized Economy: The Model of Effort-Reward Imbalance*. Springer; 2016:333-363. doi:10.1007/978-3-319-32937-6_15