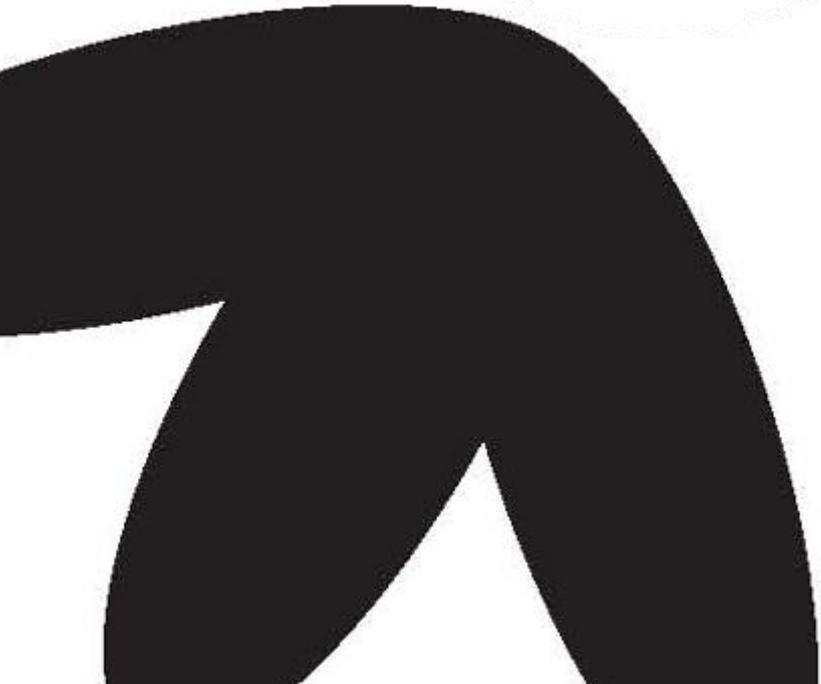




# Background document

To accompany Registration Guidelines E002

Stress related disorder



Netherlands Center  
for **Occupational Diseases**

# Background document

## To accompany Registration Guidelines E002

### Stress related disorder

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## I. Occupational stress related disorder – description of the condition

A diagnosis of an occupational stress related disorder is appropriate if the symptoms of the stress related disorder are present and if that disorder is caused or induced primarily by psychologically demanding conditions at work.

There are no reliable data on the incidence of stress related disorder. In occupational medicine, the reported incidence varies from two to seven cases per thousand working people per year. In general practice, it is between four and thirty cases per thousand patients per year.<sup>3</sup> Of the cases of work-related psychological illness cases reported to the NCvB in 2006 (a total of 1228), 81% involved stress related disorder or burnout.<sup>4</sup>

A stress related disorder can occur in any profession.

## II. Clinical diagnosis

- A stress related disorder is diagnosed on the basis of the anamnesis.

Clinical diagnosis is based on the Richtlijn handelen van de bedrijfsarts bij werkenden met psychische problemen (Guidelines for occupational physicians treating working people with psychological problems) published by the Netherlands Society of Occupational Medicine (NVAB). In those guidelines, a stress related disorder and a chronic stress related disorder (previously referred to as burnout) are grouped with stress problems under the general heading 'stress-related disorders'. In occupational medicine, the following criteria are applied:

Inclusion criteria:

One or more of the following distress symptoms (psychological stress problems):

- Malaise, apathy
- Sense of being over-burdened
- Anhedonia
- Sense of powerlessness
- Demoralization
- Depression
- Emotional instability
- Concentration problems
- Tension
- Ruminating
- Irritability
- Demotivation
- Inability to think clearly

And/or

Stress-related physical problems

- Fatigue
- Sleeping problems
- Headache
- Abdominal pain
- Muscle pain
- Etc

The condition needs to be sufficiently severe for the patient to experience or be at risk of functional problems.

**Exclusion criteria:**

Acute stress disorder  
Psychiatric pathology (Axis I or II)  
Somatic picture

Alignment with other diagnostic classifications:

Dutch GPs generally use the term 'surmenage' (ICPC code: P78). This term is therefore used alongside 'stress related disorder' in the National Primary Care Protocol on stress related disorder<sup>5</sup>.

Stress related disorder and burnout are not recognized conditions in the context of the DSM-IV, although there is a diagnosis – adjustment disorder – which closely resembles the picture of a stress related disorder. However, the term 'adjustment disorder' suggests an inability to cope and an abnormal adaptation to stressful circumstances. By contrast, research indicates that stress related disorder involves a more-or-less normal and understandable decompensation in response to excessive stressors<sup>3</sup>.

The DSM-IV gives the following criteria for a diagnosis of 'adjustment disorder':<sup>1</sup>

- The development of emotional symptoms and forms of behaviour in response to a demonstrable stress factor. The condition manifests itself within three months of the patient encountering the stress factor.
- The symptoms and the behaviour are clinically evident from the satisfaction of one or both of the following criteria:
  1. Evident tension, in excess of what one would normally associate with the relevant stress factor
  2. Clear impairment of social or occupational function
- The stress-related disorder does not meet the criteria for the diagnosis of another specific Axis I disorder and is not merely a symptom of an existing Axis I or Axis II disorder.
- The symptoms are not an expression of grief following bereavement.
- If the stress factor or its consequences are removed, the symptoms do not persist for more than six months.

Adjustment disorders are classified on the basis of their most prominent symptoms:

- Anxiety or tension – nervousness, unease, restlessness; in children fear of separation
- Depression – despair, tearfulness, despondency
- Combined anxiety and depression
- Behavioural problems – disregard for standards and rules, inappropriate behaviour
- Combined emotional and behavioural disorder – depression and/or anxiety combined with a behavioural disorder or inappropriate behaviour

Not otherwise defined – psychosocial stress, physical problems, introversion, impaired performance or concentration problems at work or study.

#### Differential diagnosis:

In diagnosis, it is necessary to differentiate stress related disorder from depressive disorder and anxiety disorders. Various anxiety disorders are defined in the DSM-IV. The NVAB Guidelines for occupational physicians treating working people with psychological problems identify 'excessive anxiety or worry' as an **inclusion criterion**. Occupational physicians are advised to use the following questions to establish whether a patient has an anxiety disorder, without seeking to differentiate the type of disorder:

Do you feel anxious; are you ever anxious for no apparent reason; do you worry a lot?  
Do you regard your anxiety and/or your worries as reasonable; do you understand them?  
Do your feelings get in the way of your everyday activities at home, at work or in your leisure time?

The **exclusion criteria** for anxiety disorder are:

The symptoms are the direct physiological consequence of substance abuse  
Somatic picture

#### **Inclusion criteria for depressive disorder (DSM-IV):**

The patient has experienced five or more of the following symptoms (including at least one of the two cardinal symptoms) within a two-week period. The symptoms cause clear distress or impair the patient's social, occupational or other important functions.

#### *Cardinal symptoms:*

- Depressive state of mind
- Clearly reduced levels of interest or enjoyment

#### *Other symptoms:*

- Altered weight or appetite
- Insomnia or excessive sleeping
- Agitation or inhibition
- Fatigue or loss of energy
- Feelings of worthlessness or excessive/irrational guilt
- Indecisiveness or concentration problems
- Recurrent thoughts about death, suicide or attempting suicide

## Exclusion criteria

- The symptoms are the direct physiological consequence of substance abuse
- Somatic picture

On the website [www.psychischenwerk.nl](http://www.psychischenwerk.nl), there are a number of tools that can be used to facilitate the differentiation of stress related disorder or burnout from depressive and anxiety disorders.

## III. Causal exposure

The system defined by the Dutch Institute for Healthcare Improvement (CBO)<sup>6</sup> has been used to define the level of the evidence for conclusions regarding associations between various work-related risk factors and a stress related disorder. See Appendix 1 for an overview of the system and the associated gradations in level of evidence. For the purposes of work-related diagnosis, both the level of the evidence and the strength of the association are taken into account. At an odds ratio of  $\geq 2$ , assuming the lower limit of the confidence interval, it may be concluded that an individual factor's contribution to the onset of the condition is sufficient to cause an occupational stress related disorder. Where the association is less strong, (odds ratio of  $> 1$  but  $< 2$ , assuming the lower limit of the confidence interval), it may be concluded merely that the factor in question contributes to the development of an occupational stress related disorder.

## Work-related psychosocial risk factors

In order to ascertain whether and to what extent work-related psychosocial risk factors contribute to the onset of stress related disorder, a systematic literature study has been carried out, encompassing literature published up to and including October 2008. In order to include both Dutch literature and literature from other countries, the term 'stress related disorder' was translated into internationally recognized measures of outcome.

Hence, the literature study focused on the term 'stress-related disorder', defined as one of the following: (1) an adjustment disorder meeting the DSM-IV criteria, (2) absence from work for psychological reasons, and (3) considerable psychological problems, as reflected in an abnormally high score from a validated questionnaire on fatigue or aspecific psychological problems.

The work-related psychosocial risk factors were classified in accordance with the definitions applied in the context of the most widely used work-stress models: the Demand-Control (-Support) model; the Effort-Reward Imbalance model; the Vitamin model; the Demand-Induced Strain Compensation model (DISC); and the Organizational Justice model. Where there was overlap between the factors defined in the models, the terminology of the first model in the list was used. All the factors identified in the studies included in the literature study are described below.

The main finding of the review is, however, that there have been only eight studies (published in seven journals) of sufficient quality, which shed light on the causal relationship between one or more work-related psychosocial risk factors and the onset of a stress related disorder.<sup>7-13</sup> Most of the literature on this subject relates to the association between work-related psychosocial risk factors and stress-related

problems without considering whether the problems in question are serious enough to constitute disorders.

The results of the literature study are summarized below. A more comprehensive overview is contained in Appendix 2.

### Psychological demands

Psychological demands are stressors, such as high time pressure, high working tempo, difficult and mentally arduous work.

Three of the included studies provide information about the relationship between psychological demands and stress related disorder.<sup>7-9</sup> Two of those studies measured exposure to psychological demands using the same questionnaire (Job Content Questionnaire; JCQ),<sup>7,9</sup> while the other used a single question formulated by the researchers.<sup>8</sup> All the studies used a version of the same questionnaire (General Health Questionnaire; GHQ) as a measure of outcome. One study additionally used a fatigue questionnaire (Checklist Individual Strength, CIS).<sup>7</sup>

Two of the three studies<sup>7,9</sup> (of which one used two measures of outcome) report a statistically significant elevated risk of a stress related disorder to (lower limit of confidence interval, OR between 1.0 and 1.24) amongst people doing psychologically demanding work. The studies in question were those that used the JCQ to measure exposure. The one study that used a single item observed no statistically significant correlation (OR 1.25; 95% CI 0.96 to 1.61).<sup>8</sup> The meta-analysis of the three studies that used the GHQ as a measure of outcome yielded an overall OR of 1.35 (95% CI 1.22 to 1.50).

|         |   |
|---------|---|
| Level 1 | <p>It has been shown that psychological demands are a risk factor for stress related disorder.</p> <p>A1: Nieuwenhuijsen et al., 2008; based on:</p> <ul style="list-style-type: none"><li>A2: Bültmann et al., 2002<sup>7</sup></li><li>A2 Mino et al., 1999<sup>8</sup></li><li>A2 Stansfeld et al., 1999<sup>9</sup></li></ul> |
|---------|---|

### Control

Control is the ability to regulate one's work and/or to influence the associated stressors.

Two of the included studies provide information about the relationship between control and stress related disorder.<sup>7,9</sup> Both of the studies in question measured control using the JCQ and used the GHQ as a measure of outcome. One study additionally used the CIS.<sup>7</sup> The two studies both used the GHQ as a measure of outcome. The pooled results of the two studies showed a statistically significant correlation between lack of control and a stress related disorder (OR 1.22; 95% CI 1.10 to 1.36). Further

analysis revealed that the pooled OR for men was just about significant (1.24; 95% CI 1.09 to 1.41), while that for women was marginally less than statistically significant (1.18; 95% CI 0.97 to 1.44).

The study that additionally used the CIS as a measure of outcome yielded higher odds ratios (men: OR 1.59; 95% CI 1.23 to 2.06; women: OR 1.51; 95% CI 1.04 to 2.19).<sup>7</sup>

|         |   |
|---------|---|
| Level 1 | <p>It has been shown that lack of control is a risk factor for a stress related disorder, particularly in men.</p> <p>A1: Nieuwenhuijsen et al., 2007; based on:</p> <p style="padding-left: 40px;">A2: Bültmann et al., 2002<sup>7</sup><br/>A2 Stansfeld et al., 1999<sup>9</sup></p> |
|---------|---|

### Social support from co-workers

Two of the included studies provide information about the relationship between social support from co-workers and a stress related disorder.<sup>7,9</sup> Both of the studies in question measured social support from co-workers using the JCQ and used the GHQ as a measure of outcome. The OR for all workers collectively was 1.24 (95% CI 1.13 to 1.37), which is statistically significant. Meta-analysis of the two studies also revealed that lack of social support from co-workers exhibited an association with the onset of stress related disorder, which was statistically significant in men and marginally less than statistically significant in women. The pooled OR for men was 1.27 (95% CI 1.13 to 1.43), while the pooled OR for women was 1.18 (95% CI 0.99 to 1.41).

One study additionally used the CIS as a measure of outcome.<sup>7</sup> That study revealed a somewhat stronger and statistically significant association between lack of support from co-workers and the onset of a stress related disorder in both men and women (men: OR 1.45; 95% CI 1.18 to 1.78; women OR 1.78; 95% CI 1.20 to 2.47).

|         |   |
|---------|---|
| Level 1 | <p>It has been shown that lack of social support from co-workers is a risk factor for a stress related disorder, particularly in men.</p> <p>A1: Nieuwenhuijsen et al., 2007; based on:</p> <p style="padding-left: 40px;">A2: Bültmann et al., 2002<sup>7</sup><br/>A2 Stansfeld et al., 1999<sup>10</sup></p> |
|---------|---|

### Social support from supervisor

Three of the included studies provide information about the relationship between social support from co-workers and stress related disorder.<sup>7-9</sup> Two of the three studies measured social support from supervisor using the JCQ,<sup>7,9</sup> while the other used a single question formulated by the researchers.<sup>8</sup> All the studies used a version of the same questionnaire (General Health Questionnaire; GHQ) as a

measure of outcome. One study additionally used a fatigue questionnaire (Checklist Individual Strength, CIS).<sup>7</sup>

The OR for all workers collectively was 1.24 (95% CI 1.13 to 1.35), which is statistically significant. Further analysis revealed the pooled OR for men to be statistically significant (1.28; 95% CI 1.14 to 1.44), while the pooled OR for women was marginally less than statistically significant (1.11; 95% CI 0.96 to 1.30).

The study<sup>7</sup> that additionally used the CIS as a measure of outcome also found a slightly greater, statistically significant, OR for men (1.38; 95% CI 1.12 to 1.69). The OR for women was smaller and not statistically significant (1.17; 95% CI 0.86 to 1.58).

|         |  |
|---------|--|
| Level 1 | <p>It has been shown that lack of social support from supervisor is a risk factor for stress related disorder, particularly in men.</p> <p>A1: Nieuwenhuijsen et al., 2007; based on:</p> <p style="padding-left: 40px;">A2: Bültmann et al., 2002<sup>7</sup></p> <p style="padding-left: 40px;">A2 Mino et al., 1999<sup>9</sup></p> <p style="padding-left: 40px;">A2 Stansfeld et al., 1999<sup>10</sup></p> |
|---------|--|

### Career opportunities

One study provides information about the relationship between lack of career opportunities and a stress related disorder.<sup>7</sup> Although the 'career opportunities' factor can embrace promotion opportunities, job security and retention of status, the study in question only considered job security, which was assessed on the basis of a single item on the *Vragenlijst Beleving en Beoordeling Arbeid* (Work Perceptions and Assessment Questionnaire; VBBA). Analysis of the selected measure of outcome (GHQ) revealed a significant association between job security and the onset of stress related disorder in men (OR 1.63; 95% CI 1.18 to 2.27), but not in women. However, when the CIS was used as a measure of outcome, no statistically significant association between job security and stress related disorder was apparent in either men or women.

|         |   |
|---------|---|
| Level 3 | <p>There is moderate evidence that lack of job security is a risk factor for a stress related disorder in men.</p> <p style="padding-left: 40px;">A2: Bültmann et al., 2002<sup>7</sup></p> |
|---------|---|

### Varied work

One study provides information about the relationship between insufficiently varied work and stress related disorder.<sup>10</sup> The study in question investigated whether people with repetitive jobs were more likely to suffer stress related disorder, as measured on the Setterlind Stress Inventory. No such association was found (OR 1.3; 95% CI 0.6 to 2.2).

|         |   |
|---------|---|
| Level 3 | There is as yet no evidence that insufficiently varied work is a risk factor for stress |
|---------|---|

|  |   |
|--|---|
|  | <p>related disorder.</p> <p>A2: Bonde et al., 2005<sup>10</sup></p> |
|--|---|

### Emotional demands

Emotional demands are stressors associated with work necessitating a high degree of emotional or personal involvement. One study provides information about the relationship between emotional demands and a stress related disorder.<sup>7</sup> Exposure to emotional demands was investigated using a single item from the VBBA. Where the GHQ was used as a measure of outcome, a statistically significant association was found in both men and women (ORs respectively 1.73; 95% CI 1.40 to 2.14 and 1.39; 95% CI 1.01 to 1.91). Where the CIS was used as a measure of outcome, a significant association was found between emotional demands and the onset of stress related disorder only in men (OR 1.47; 95% CI 1.14 to 1.88).

|         |   |
|---------|---|
| Level 3 | <p>There is moderate evidence that emotional demands are a risk factor for stress related disorder, particularly in men.</p> <p>A2: Bültmann et al., 2002<sup>7</sup></p> |
|---------|---|

### Procedural justice

Procedural justice is a product of the processes within an organization: whether the formal decision-making procedures within an organization are perceived to be fair.

Two studies provide information about the relationship between lack of procedural justice within an organization and a stress related disorder.<sup>13</sup> The studies, both of which used the GHQ as a measure of outcome, found that lack of procedural justice was indeed associated with stress related disorder (pooled OR: 1.78; 95% CI 1.59 to 2.00).

|         |   |
|---------|---|
| Level 1 | <p>It has been shown that lack of procedural justice within an organization is a risk factor for stress related disorder.</p> <p>A1: Nieuwenhuijsen et al., 2007; based on:</p> <p style="padding-left: 40px;">A2 Kivimäki et al., 2007a<sup>13</sup></p> <p style="padding-left: 40px;">A2 Kivimäki et al., 2007b<sup>13</sup></p> |
|---------|---|

### Relational justice

Relational justice is predominantly a product of the relationship with management, e.g. whether the management is perceived to be impartial, reliable and honest.

Two studies provide information about the relationship between lack of relational justice within an organization and stress related disorder.<sup>13</sup> The studies, both of which used the GHQ as a measure of outcome, found that lack of relational justice was associated with the onset of a stress related disorder (pooled OR 1.51; 95% CI 1.35 to 1.69).

|         |   |
|---------|---|
| Level 1 | <p>It has been shown that lack of relational justice within an organization is a risk factor for a stress related disorder.</p> <p>A1: Nieuwenhuijsen et al., 2007; based on:</p> <p style="padding-left: 40px;">A2 Kivimäki et al., 2007a<sup>13</sup></p> <p style="padding-left: 40px;">A2 Kivimäki et al., 2007b<sup>13</sup></p> |
|---------|---|

### Effort-reward imbalance

The Effort-Reward Imbalance model (Siegrist, 1996) distinguishes two categories of work characteristics: effort characteristics and reward characteristics. Effort characteristics include: time pressure, physical effort and interruptions. Reward characteristics include: financial rewards (pay, allowances, etc), appreciation (respect and support), security and development opportunities (promotion opportunities, retention of status).

Four studies provide information about the relationship between effort-reward imbalance and the onset of stress related disorder.<sup>9; 12; 13</sup> Three studies used the GHQ as a measure of outcome,<sup>9; 13</sup> while one study used the Abbreviated Fatigue Questionnaire (VWV).<sup>12</sup> The study that used the VWV found a statistically significant association in men (OR 3.4; 95% CI 1.7 to 6.7) but not in women (OR 2.0; 95% CI 0.9 to 4.1). Since only one of the three GHQ studies reported separate findings for men and women, the pooled OR for the two groups was calculated. Together, the studies revealed a statistically significant correlation between effort-reward imbalance and the onset of stress related disorder (pooled OR 1.98; 95% CI 1.78 to 2.20).

|         |  |
|---------|--|
| Level 1 | <p>It has been shown that effort-reward imbalance is a risk factor for stress related disorder.</p> <p>A1: Nieuwenhuijsen et al., 2007; based on:</p> <p style="padding-left: 40px;">A2 Stansfeld et al., 1999<sup>9</sup></p> <p style="padding-left: 40px;">A2 Kivimäki et al., 2007a<sup>13</sup></p> <p style="padding-left: 40px;">A2 Kivimäki et al., 2007b<sup>13</sup></p> |
|---------|--|

### Other psychosocial risk factors

Although many psychosocial risk factors have not (yet) been shown to play a role in the onset of stress related disorder, that may simply reflect the fact that few (if any) studies of the factors in question have been performed. Conflict at work is a good example: it is known to play a role in the onset of psychological problems<sup>14</sup> and it is likely to play a role in the onset of a stress related disorder as well, but the latter association has yet to be investigated.

## IV. Work-related diagnosis

Group-level information about work-related psychosocial risk factors is typically collected using questionnaires. However, the questionnaires in use often cover only some of the relevant risk factors

(depending on the theoretical model used). Furthermore, the use of questionnaires at the individual level has not been adequately investigated. It is therefore advisable to assess psychosocial risk factors by reference to the occupational anamnesis, possibly supplemented by information from risk inventory and evaluation (RI&E) exercises.

## V. Non-work-related factors

A significant contributor to a stress related disorder is often stress associated with problems and events in one's environment and one's reaction to the demand and requirements coming from the work environment, although factors from the wider environment must not be discounted. Stressful life events may be catalogued using the Life Event Inventory (see Appendix 3). Although no systematic research has yet been carried out into the relationship between a combination of work-related stress and non-work-related stress and the onset of stress related disorder, there are indications that, where other outcomes are concerned (e.g. general absenteeism, depression, anxiety), if someone who is exposed to stress at work is additionally exposed to stress outside work, the risk increases.<sup>15; 16</sup>

### *Predisposing factors*

#### History of psychological problems

In 2007, a longitudinal study was carried out into the relationship between work characteristics and burnout and depression in dentists in Finland.<sup>17</sup> Job strain (very psychologically demanding work in combination with lack of control) was associated with the onset of burnout, even after correcting for pre-existing depressive symptoms. Moderate evidence has also been found that stress at work can contribute to the onset of a stress related disorder in workers who have previously suffered depression.

#### Personality

We do not know of any systematic research into the role that personality and exposure at work play in the onset of stress related disorder and burnout. However, where depression is concerned, we know that personality cannot fully explain the relationship between work characteristics and depressive problems.

Nevertheless, personality and individual sensitivity should be taken into account by an occupational physician when deciding whether a patient's condition is work-related. However, even if individual sensitivity is suspected, an occupational physician is advised to treat a stress related disorder as work-related if a patient was sufficiently exposed at work and if his/her performance was previously good.

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## Appendix 1 Methodological quality of studies and level of evidence for conclusions

Table 1.1 Classification of methodological quality of studies into damage or side-effects, aetiology and prognosis

|    |   |
|----|---|
| A1 | Systematic review of at least two mutually independent A2-level studies   |
| A2 | Prospective cohort study of sufficient scale and follow-up, with satisfactory controls for confounding variables and exclusion of selective follow-up |
| B  | Prospective cohort study not exhibiting all the features specified under A2, or retrospective cohort study, or patient-control study                  |
| C  | Non-comparative study   |
| D  | Expert opinion  |

Table 1.2 Level of evidence for conclusions, as determined from the strength of the evidence offered in support of the conclusion

| Level | Conclusion based on   |
|-------|---|
| 1     | One systematic review (A1) or at least two mutually independent A2-level studies<br><i>It has been shown that ...</i>                       |
| 2     | At least two mutually independent B-level studies<br><i>There is strong evidence that ...</i>   |
| 3a    | One A2-level or B-level study, or at least one C-level study<br><i>There is moderate evidence that ...</i>                                  |
| 3b    | One C-level study<br><i>There is limited evidence that ...</i>  |
| 4     | Expert opinion (e.g. opinion of workgroup members)<br><i>Within the Registration Guidelines Committee, there is consensus regarding ...</i> |

## Appendix 2: Psychological risk factors and their association with the onset of stress related disorder

| Risk factor                  | Study          | Exposure definition  | Outcome definition                | Estimated effect OR (CI)                                  | Corrected for  | Pooled* OR (CI)              |
|------------------------------|----------------|--|-----------------------------------|---|--|------------------------------|
| <b>Psychological demands</b> | Bültmann 2002  | JCQ <sup>#</sup> , job demands<br>(highest v. lowest tertile)          | a: >76 on the CIS <sup>Ω</sup>    | a: Men: 1.28 (1.0 to 1.64)<br>Women: 1.57 (1.09 to 2.26)  | a: Age, education, living alone, work status, ill health, baseline GHQ-score           | <b>All: 1.35 (1.22-1.50)</b> |
|                              |                |  | b: ≥ 4 on the GHQ-12 <sup>^</sup> | b: Men: 1.51 (1.23 to 1.85)<br>Women: 1.44 (1.03 to 2.01) | b: Same as a, but with baseline CIS-score instead of GHQ                               |                              |
|                              | Mino 1999      | Single item<br>(always/sometimes present v. absent)                    | ≥ 8 on the GHQ-30 <sup>^^</sup>   | 1.25 (CI 0.96 to 1.61)                                    | Gender, age, satisfaction with family life, self-reported physical health              |                              |
|                              | Stansfeld 1999 | Adapted JCQ <sup>##</sup> , job demands<br>(highest v. lowest tertile) | > 4 on the GHQ-30 <sup>^^</sup>   | Men: 1.33 (1.1 to 1.6)<br>Women: 1.24 (1.0 to 1.6)        | Subcohort of non-baseline cases, corrected for age, work status and baseline GHQ-score |                              |
| <b>Total:</b>                |                |  |                                   |   |  |                              |
| <b>Control</b>               | Bültmann 2002  | JCQ <sup>#</sup> , decision latitude<br>(lowest v. highest tertile)    | a: >76 on the CIS <sup>Ω</sup>    | a: Men: 1.59 (1.23 to 2.06)<br>Women: 1.51 (1.04 to 2.19) | a: Age, education, living alone, work status, ill health, baseline GHQ-score           |                              |
|                              |                |  | b: ≥ 4 on the GHQ-12 <sup>^</sup> | b: Men: 1.14 (0.9 to 1.43)<br>Women: 0.88 (0.62 to 1.24)  | b: same as a, but with baseline CIS-score instead of GHQ                               |                              |

| Risk factor                           | Study          | Exposure definition  | Outcome definition  | Estimated effect OR (CI)   | Corrected for  | Pooled* OR (CI)   |
|---------------------------------------|----------------|--|---|--|--|---|
|                                       | Stansfeld 1999 | Adapted JCQ <sup>##</sup> , decision latitude<br>(lowest v. highest tertile) | > 4 on the GHQ-30 <sup>^^</sup>   | Men: 1.29 (1.1 to 1.5)<br>Women: 1.37 (1.1 to 1.8)   | Subcohort of non-baseline cases, corrected for age, work status and baseline GHQ-score   |   |
| <b>Total:</b>                         |                |  |   |  |  | <b>All: 1.22 (1.10-1.36)</b><br><b>Men: 1.24 (1.09-1.41)</b><br><b>Women: 1.18 (0.97- 1.44)</b> |
| <b>Social support from co-workers</b> | Bültmann 2002  | JCQ <sup>#</sup> , co-worker support<br>(low v. high)                        | a: >76 on the CIS <sup>Ω</sup><br><br>b: ≥ 4 on the GHQ-12 <sup>^</sup> | a: Men: 1.45 (1.18 to 1.78)<br>Women: 1.78 (1.20 to 2.47)<br><br>b: Men: 1.25 (1.04 to 1.49)<br>Women: 1.31 (0.97 to 1.78) | a: age, education, living alone, work status, ill health, baseline GHQ-score<br><br>b: same as a, but with baseline CIS-score instead of GHQ |   |
|                                       | Stansfeld 1999 | Adapted JCQ <sup>##</sup> , co-worker support<br>(lowest v. highest tertile) | > 4 on the GHQ-30 <sup>^^</sup>   | Men: 1.29 (1.1 to 1.5)<br>Women: 1.12 (0.9 to 1.4)   | Age, work status and baseline GHQ-score  |   |
| <b>Total:</b>                         |                |  |   |  |  | <b>All: 1.24 (1.13-1.37)</b><br><b>Men: 1.27 (1.13-1.43)</b><br><b>Women: 1.18 (0.99- 1.41)</b> |
| <b>Social support from supervisor</b> | Bültmann 2002  | JCQ <sup>#</sup> , supervisor support<br>(low v. high)                       | a: >76 on the CIS <sup>Ω</sup>  | a: Men: 1.38 (1.12 to 1.69)<br>Women: 1.17 (0.86 to 1.58)  |  |   |

| Risk factor                 | Study          | Exposure definition   | Outcome definition  | Estimated effect OR (CI)   | Corrected for   | Pooled* OR (CI)   |
|-----------------------------|----------------|---|---|--|---|---|
|                             |                |   | b: ≥ 4 on the GHQ-12 <sup>^</sup>                                   | b: Men: 1.25 (1.05 to 1.49)<br>Women: 1.12 (0.85 to 1.47)  |   |   |
|                             | Mino 1999      | Single item<br>( <i>always/sometimes present v. absent</i> )                            | ≥ 8 on the GHQ-30 <sup>^^</sup>                                     | 1.54 (CI 1.07 to 2.19)   | Gender, age, satisfaction with family life, reported physical health  |   |
|                             | Stansfeld 1999 | Adapted JCQ <sup>###</sup> , supervisor support<br>( <i>lowest v. highest tertile</i> ) | > 4 on the GHQ-30 <sup>^^</sup>                                     | Men: 1.31 (1.1 to 1.5)<br>Women: 1.11 (0.9 to 1.3)   | Age, work status and baseline GHQ-score   |   |
| <b>Total:</b>               |                |   |   |  |   | <b>All: 1.24 (1.13-1.35) Men: 1.28 (1.14- 1.44) Women: 1.11 (0.96- 1.3)</b> |
| <b>Career opportunities</b> | Bültmann 2002  | QPJW <sup>§</sup> , single item job insecurity<br>( <i>yes v. no</i> )                  | a: >76 on the CIS <sup>Ω</sup><br>b: ≥ 4 on the GHQ-12 <sup>^</sup> | a: Men: 0.93 (0.62 to 1.39)<br>Women: 1.33 (0.77 to 2.28)<br>b: Men: 1.63 (1.18 to 2.27)<br>Women: 0.94 (0.56 to 1.59) | a: age, education, living alone, work status, ill health, baseline GHQ-score<br>b: same as a, but with baseline CIS-score instead of GHQ                                |   |
| <b>Total:</b>               |                |   |   |  |   | <b>N/a</b>  |
| <b>Varied work</b>          | Bonde 2005     | Repetitive work <sup>∞</sup><br>( <i>yes v. no</i> )                                    | ≥ 4 on the Setterlind Stress Inventory                              | 1.3 (0.6 to 2.2)   | Subcohort of non-baseline cases, corrected for gender, age, physical activity, BMI, personality (intrinsic effort), marital status, self-reported psychiatric condition |   |

| Risk factor               | Study                                 | Exposure definition  | Outcome definition  | Estimated effect OR (CI)   | Corrected for  | Pooled* OR (CI)              |
|---------------------------|---------------------------------------|--|---|--|--|------------------------------|
| <b>Total:</b>             |                                       |  |   |  |  | <b>N/a</b>                   |
| <b>Emotional demands</b>  | Bültmann 2002                         | QPJW <sup>§</sup> , emotional demands<br><br><i>(high v. none)</i>                                       | a: >76 on the CIS <sup>Ω</sup><br><br>b: ≥ 4 on the GHQ-12 <sup>^</sup> | a: Men: 1.47 (1.14 to 1.88)<br>Women: 1.04 (0.73 to 1.48)<br>b: Men: 1.73 (1.40 to 2.14)<br>Women: 1.39 (1.01 to 1.91) | a: age, education, living alone, work status, ill health, baseline GHQ-score<br>b: same as a but, with baseline CIS-score instead of GHQ |                              |
| <b>Total:</b>             |                                       |  |   |  |  | <b>N/a</b>                   |
| <b>Procedural justice</b> | Kivimäki 2007<br><br>(10 town study)  | Organizational justice <sup>&amp;</sup> ,<br>procedural injustice<br><i>(highest v. lowest quartile)</i> | ≥ 4 on the GHQ-12 <sup>^</sup>  | 1.81 (1.60 to 2.06)  | Age, gender and occupation   |                              |
|                           | Kivimäki 2007<br><br>(hospital study) | Organizational justice <sup>&amp;</sup> ,<br>procedural injustice<br><i>(highest v. lowest quartile)</i> | ≥ 4 on the GHQ-12 <sup>^</sup>  | 1.67 (1.29 to 2.15)  | Age, gender and occupation   |                              |
| <b>Total:</b>             |                                       |  |   |  |  | <b>All: 1.78 (1.59-2.00)</b> |

| Risk factor                    | Study                             | Exposure definition  | Outcome definition  | Estimated effect OR (CI)                           | Corrected for   | Pooled* OR (CI)              |
|--------------------------------|-----------------------------------|--|---|--|---|------------------------------|
| <b>Relational justice</b>      | Kivimäki 2007<br>(10 town study)  | Organizational justice <sup>&amp;</sup> ,<br>relational injustice<br><i>(highest v. lowest quartile)</i>                             | ≥ 4 on the GHQ-12 <sup>^</sup>  | 1.50 (1.32 to 1.70)                                | Age, gender and occupation  |                              |
|                                | Kivimäki 2007<br>(Hospital study) | Organizational justice <sup>&amp;</sup> ,<br>relational injustice<br><i>(highest v. lowest quartile)</i>                             | ≥ 4 on the GHQ-12 <sup>^</sup>  | 1.56 (1.21 to 2.02)                                | Age, gender and occupation  |                              |
| <b>Total:</b>                  |                                   |  |   |  |   | <b>All: 1.51 (1.35-1.69)</b> |
| <b>Effort-reward imbalance</b> | Godin 2005                        | Effort- reward imbalance <sup>@</sup><br><i>(highest quartile v. rest on ratio)</i>  | Upper quartile or<br>distribution short<br>fatigue inventory <sup>+</sup> | Men: 3.4 (1.7 to 6.7)<br>Women: 2.0 (0.9 to 4.1)   | Age, education, threat of globalization,<br>job satisfaction, instability of<br>employment organization |                              |
|                                | Stansfeld 1999                    | Indicator of effort-reward<br>imbalance <sup>++</sup><br><i>(high efforts/low rewards<br/>v. no high efforts or low<br/>rewards)</i> | > 4 on the GHQ-30 <sup>^^</sup>   | Men: 2.57 (1.8 to 3.6)<br>Women: 1.67 (1.0 to 2.9) | Subcohort of non-baseline cases,<br>corrected for age, work status and<br>baseline GHQ-score            |                              |
|                                | Kivimäki 2007<br>(10 town study)  | Proxy of effort-reward<br>imbalance <sup>@</sup><br><i>(highest v. lowest quartile)</i>  | ≥ 4 on the GHQ-12 <sup>^</sup>  | 2.04 (1.80 to 2.32)                                | Age, gender and occupation  |                              |

| Risk factor   | Study                             | Exposure definition  | Outcome definition | Estimated effect OR (CI) | Corrected for              | Pooled* OR (CI)             |
|---------------|-----------------------------------|--|--------------------|--------------------------|----------------------------|-----------------------------|
|               | Kivimäki 2007<br>(Hospital study) | Proxy of effort-reward imbalance@<br><i>(highest v. lowest quartile)</i> | ≥ 4 on the GHQ-12^ | 1.59 (1.24 to 2.05)      | Age, gender and occupation |                             |
| <b>Total:</b> |                                   |  |                    |                          |                            | <b>All 1.98 (1.78-2.20)</b> |

\* Pooled estimate from all studies using GHQ as outcome measure

N/a = pooled estimate could not be calculated because number of studies with same outcome measure was less than two

# = Job Content Questionnaire (Karasek, 1985)

Ω = CIS = Checklist Individual Strength (Vercoulen et al, 1994, 1999)

^ = GHQ-12 = General Health Questionnaire – 12 items (Goldberg, 1992)

^^ GHQ = General Health Questionnaire (Goldberg, 1972)

## = Adapted Job Content Questionnaire (Karasek & Theorell, 1990)

\$ = Questionnaire on Perception and Judgement of Work (Van Veldhoven & Meijman, 1994)

∞ = Classification of repetitive work by ergonomists (Fallentin et al, 2001)

& = Organizational Justice (Elovainio, Kivimaki, Vahtera, 2002)

@ Effort- Reward imbalance (Siegrist, Starke, Chandola, Godin, Marmot, Niedhammer, Peter, 2004)

+ = Short Fatigue Inventory (Alberts, Smets, Vercoulen, Garssen & Bleijenberg, 1997)

++ = Indicator of effort-reward imbalance (Bosma, Peter, Siegrist, 1998)

## Appendix 3 Life Events S

|                                       |     |
|---------------------------------------|-----|
| Death of partner                      | 100 |
| Divorce                               | 73  |
| Separation from partner               | 65  |
| Imprisonment                          | 63  |
| Death of close relative               | 63  |
| Personal injury or illness            | 53  |
| Marriage                              | 50  |
| Loss of job                           | 47  |
| Marital reconciliation                | 45  |
| Retirement                            | 45  |
| Illness of close relative             | 44  |
| Pregnancy                             | 40  |
| Sexual problems                       | 39  |
| Addition to the family                | 39  |
| New job                               | 39  |
| Financial problems                    | 38  |
| Death of close friend                 | 37  |
| Change in responsibilities at work    | 36  |
| Increasing marital problems           | 35  |
| Large mortgage                        | 31  |
| Refusal of credit                     | 30  |
| Increased responsibilities            | 29  |
| Children leaving parental home        | 29  |
| Problems with in-laws                 | 29  |
| High expectations                     | 28  |
| Partner starting/stopping work        | 26  |
| Starting/leaving school               | 26  |
| New living arrangements               | 25  |
| Lifestyle change                      | 24  |
| Disagreement with manager             | 23  |
| New working hours and/or arrangements | 20  |
| Moving house                          | 20  |
| Moving school                         | 20  |
| Change in available leisure time      | 19  |
| Religious conversion                  | 19  |
| Change in social life                 | 18  |
| Arranging a loan                      | 17  |
| Change in sleeping habits             | 16  |
| More/less contact with family         | 15  |
| Change in eating habits               | 15  |
| Holiday                               | 13  |
| Christmas                             | 12  |
| Minor legal penalty                   | 11  |