

## REVIEW

# Reducing work related psychological ill health and sickness absence: a systematic literature review

S Michie, S Williams

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A literature review revealed the following: key work factors associated with psychological ill health and sickness absence in staff were long hours worked, work overload and pressure, and the effects of these on personal lives; lack of control over work; lack of participation in decision making; poor social support; and unclear management and work role. There was some evidence that sickness absence was associated with poor management style. Successful interventions that improved psychological health and levels of sickness absence used training and organisational approaches to increase participation in decision making and problem solving, increase support and feedback, and improve communication. It is concluded that many of the work related variables associated with high levels of psychological ill health are potentially amenable to change. This is shown in intervention studies that have successfully improved psychological health and reduced sickness absence.

prevent or reduce psychological ill health and sickness absence. The primary focus of this review is the association between work factors and psychological ill health among health care staff. However, because of the paucity of evidence in health care,<sup>1</sup> evidence was reviewed across all work settings, although presented separately for health care workers where appropriate.

## METHODS

Our review method was based on that used by the NHS Centre for Reviews and Dissemination.<sup>6</sup> This method involves a systematic examination of selected databases using a variety of strategies, including keywords and subject headings. It allows the integration of quantitative data across studies, where they have similar outcome measures, and the summary of findings where methods used are diverse.

## Identification of papers

Four electronic databases were used: Medline (1987–99), PsychInfo (1987–99), Embase (1991–99), and the Cochrane Controlled Trials Register (1987–99). Relevant papers up to and including 1997 were selected from a larger study.<sup>1</sup> The search strategy in the larger study was of MeSH key words and text words in each of three categories: work factors; staff; and ill health/absenteeism/economic consequences. The search included all types of employment and all developed countries but was limited to abstracts in English. Secondary references were chosen from the primary paper references and by contacting academics researching this area. Psychological ill health included measures of anxiety, depression, emotional exhaustion, and psychological distress (“stress” was excluded since it is a mediating hypothetical construct rather than an outcome measure of psychological ill health). For the purpose of this review, papers from 1998 and 1999 were identified using the same search strategy, but excluding physical ill health and economic consequences.

## Selection criteria

Abstracts were selected for retrieval of the paper if they were judged to include data about both work factors and psychological ill health or absenteeism. Dissertations were excluded, as were studies of very specific staff groups or settings, work patterns (for example, shift working), or events (for example, violence). All abstracts were selected independently by two researchers (three researchers were involved in this activity). The percentage of abstracts for which two researchers agreed about inclusion and exclusion varied

Levels of ill health, both physical and psychological, and associated sickness absence are high among those working in health care in the UK.<sup>1,2</sup> This problem is not unique to the UK.<sup>3</sup> Poor psychological health and sickness absence are likely to lead to problems for patients in that both the quantity and quality of patient care may be diminished. Because most health care is provided by staff working in teams, ill health and sickness absence in any one individual is likely to cause increased work and stress for other staff.

Several explanations have been put forward for this high level of ill health, including the nature of the work, organisational changes, and the large amounts and pressure of work.<sup>4</sup> A comparison across UK hospitals in the public sector found that rates of psychological ill health varied from 17% to 33%, with lower rates in hospitals characterised by smaller size, greater cooperation, better communication, more performance monitoring, a stronger emphasis on training, and allowing staff more control and flexibility in their work.<sup>5</sup> This supports the notion that organisational factors may contribute to the level of psychological ill health experienced by staff.

To tackle the problem of work related psychological ill health, evidence is needed about the work factors associated with psychological ill health and sickness absence, and about interventions that have been implemented successfully to

See end of article for authors' affiliations

Dr S Michie, Reader in Clinical Health Psychology, Centre for Outcomes Research and Effectiveness, Department of Psychology, University College London, Gower Street, London WC1E 6BT, UK; s.michie@ucl.ac.uk

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**Table 1** Summary of observational studies of associations between work factors and ill health: health care workers in UK

Study	Design	Participants	Response rate	Work factors	Outcomes	Results
Agius <i>et al</i> , 1996 <sup>7</sup>	Cross sectional	375 consultant doctors	75%	Work demands	Emotional exhaustion (MBI)	High academic work demands associated with low emotional exhaustion ( $r=-0.14$ , $p<0.05$ )
Baglioni <i>et al</i> , 1990 <sup>8</sup>	Cross sectional	475 senior nurses	80%	Workload	Mental health (CCEI)	No association
Baldwin <i>et al</i> , 1997 <sup>9</sup>	Longitudinal	142 junior doctors	95%	Long hours	Psychological distress (GHQ-28)	No association overall; association with somatic symptoms, $r=0.24$
Cooper <i>et al</i> , 1988 <sup>10</sup>	Cross sectional	484 dentists	85%	Time pressures, pay stressors and technical problems	Mental health (CCEI)	Time pressures, pay stressors and technical problems associated with poor mental health (respective $Bs=0.24$ , $0.20$ , $0.12$ ; $F=20.54$ , $p<0.001$ )
Deary <i>et al</i> , 1996 <sup>11</sup>	Cross sectional	333 consultant doctors	67%	Clinical workload	Psychological distress (GHQ-28), emotional exhaustion (MBI)	High clinical workload associated with emotional exhaustion ( $\chi^2$ for model= $30.31$ , $p=0.11$ , satisfactory fit)
Heyworth <i>et al</i> , 1993 <sup>12</sup>	Cross sectional	201 trainee and consultant doctors	72%	Task clarity, supportive communication	Depression (CES-D)	Task clarity and supportive communication associated with lower depression ( $r=-0.51$ and $-0.36$ respectively, $p=0.0001$ )
Parkes, 1982 <sup>13</sup>	Experimental	164 student nurses	97%	Job demand, discretion, social support	Anxiety (GHQ), depression (CCEI), sickness absence	Anxiety and depression associated with low job discretion and job support ( $r=-0.30$ and $-0.35$ for anxiety and $-0.26$ and $-0.36$ for depression) and job demand was negatively associated with sickness absence ( $r=-0.24$ )
Quine, 1999 <sup>14</sup>	Cross sectional	1100 health care workers	70%	Bullying	Anxiety, depression (HADS)	Bullying associated with higher anxiety (30% v 9%, $p<0.001$ ) and depression (8% v 1%, $p<0.001$ )
Rees and Cooper, 1992 <sup>15</sup>	Cross sectional	1176 health care workers	67%	Control over work (OSI)	Sickness absence	No association
Sutherland and Cooper, 1993 <sup>16</sup>	Cross sectional	917 family doctors	61%	Job demands	Anxiety, depression and somatic anxiety (CCEI)	Associations with anxiety ( $\beta=0.17$ ) depression ( $\beta=0.28$ ) and somatic anxiety ( $\beta=0.23$ )
Tyler and Cushway, 1992 <sup>17</sup>	Cross sectional	72 nurses	60%	Workload, conflict, social support	Psychological distress (GHQ 28)	GHQ predicted by managing the workload ( $\beta=0.32$ )

between 80% and 90%. Disagreements were resolved by discussion.

### Information extraction

Information from papers was extracted and coded within the following categories: study aim, study design, type of study population (for example, occupational group), sampling strategy, sample size and response rate, demographic characteristics, type of intervention, type of study measure, main outcomes, and summary of results.

### Further selection criteria

Coded papers excluded from the review were studies with: volunteer or inadequately described sample; response rate of less than 60%; no standardised measures of psychological outcome.

## RESULTS

Of the studies identified as part of the larger study,<sup>1</sup> 40 were selected for this study (34 associations and six interventions). A further nine studies meeting the above selection criteria were identified in the period 1998–99, all of associations. No studies were found in the Cochrane Controlled Trials Register. The results are summarised in tables 1–4.

Because these studies were diverse in terms of outcomes and measures used to assess these outcomes, a meta-analysis was not appropriate.

### Associations with work

The results are presented in three groups: health care workers in the UK, health care workers in other developed countries, and non-health care workers. This enabled an assessment of whether associations between work factors and psychological ill health are similar across sector and country.

### Health care

In the UK, factors associated with psychological ill health in doctors, from junior to senior grades, are long hours worked,<sup>9</sup> high workload and pressure of work,<sup>7 16 11</sup> and lack of role clarity<sup>12</sup> (table 1). Pressure of work has also been found to be associated with poor mental health in dentists.<sup>10</sup> In family doctors, the issues were interruptions during and outside surgery hours and patient demands.<sup>16</sup>

Among UK nurses, the most frequently reported source of psychological ill health was workload pressures.<sup>17</sup> Distress in student nurses has been caused by low involvement in decision making and use of skills, and low social support at work.<sup>13</sup> In a study of health care workers across job type, bullying was found to be prevalent, carried out mainly by managers and associated with both anxiety and depression.<sup>14</sup> Of the two studies addressing sickness absence, one found a negative association with job demands,<sup>13</sup> while the other found no association with control over work.<sup>15</sup>

Similar factors are associated with psychological ill health in health care workers in the rest of Europe, the USA, and Australia (table 2). The one study of doctors found an association between work control and social support and psychological distress.<sup>22</sup> Among nurses, lack of co-worker support,<sup>24 27</sup> job influence,<sup>26</sup> and organisational climate and role ambiguity<sup>28</sup> were associated with psychological distress. Among other hospital workers, work overload and pressure, role ambiguity, lack of control over work, and lack of participation in decision making were all found to be associated with distress.<sup>18 20 25</sup>

Sickness absence was associated with work pressures and lack of training,<sup>23</sup> unsupportive management style,<sup>21</sup> role ambiguity, tolerance of absenteeism, and low pay.<sup>19</sup>

### Beyond health care

The picture among non-health care workers in Europe and the USA was similar to that of health care workers (table 3). The

**Table 2** Summary of observational studies of associations between work factors and ill health: health care workers in developed countries beyond the UK

Study	Country	Design	Participants	Response rate	Work factors	Outcomes	Results
Arsenault <i>et al</i> , 1991 <sup>18</sup>	Canada	Cross sectional	760 hospital workers	Not reported	Professional latitude, clinical demands, workload problems, role difficulties	Mental strain including depression (Cobb) and anxiety (STAI)	Low professional latitude ( $F=12.7$ , $p<0.001$ ) and high workload problems ( $F=4.5$ , $p<0.04$ ) and role difficulties ( $F=31.6$ , $p<0.001$ ) associated with mental strain
Brooke and Price, 1989 <sup>19</sup>	USA	Cross sectional	425 hospital workers	74%	Routinisation, centralisation, pay, reward policy, role ambiguity, conflict, overload, organisational tolerance of absenteeism	Absenteeism	High role ambiguity and tolerance of absenteeism, low pay and low centralisation predicted absenteeism (structural coefficients $0.21$ , $p<0.001$ ; $0.27$ , $p<0.001$ ; $-0.11$ , $p<0.05$ ; $-0.19$ , $p<0.02$ , respectively)
Estryn-Behar <i>et al</i> , 1990 <sup>20</sup>	France	Cross sectional	1505 female hospital workers	90%	Mental load, insufficient training, time pressure	Psychological distress (GHQ-12)	Mental load and time pressure associated with psychological distress (ORs 2.9 and 2.2)
Gray-Toft and Anderson, 1985 <sup>21</sup>	USA	Experimental	159 nurses	Not reported	Open, supportive supervisory style	Absenteeism	Open supportive supervisory style associated with lower absenteeism (relevant statistics not presented)
Johnson <i>et al</i> , 1995 <sup>22</sup>	USA	Longitudinal	581 doctors	86%	Job demands, work control, social support	Psychological distress (GHQ-20)	Work control and social support negatively associated with psychological distress ( $B=-0.44$ , $p=0.05$ and $B=-0.46$ , $p=0.05$ )
Landeweerd and Boumans, 1994 <sup>23</sup>	Netherlands	Cross sectional	561 nurses	96%	Work pressure, job complexity, feedback, autonomy, promotion/training	Absence frequency	Work pressures associated with absence frequency ( $B=0.12$ ) and promotion/training negatively associated ( $B=-0.12$ )
Marshall & Barnett, 1992 <sup>24</sup>	USA	Cross sectional	362 female nurses and social workers	Not reported	Work related support, job overload	Psychological distress (SCL-90-R) and emotional well-being (Rand Corporation)	Co-worker support associated with emotional wellbeing ( $B=-0.20$ , $p<0.01$ )
Martin, 1984 <sup>25</sup>	USA	Cross sectional	95 and 140 hospital workers	63% and 70%	Work overload and ambiguity, participation in decision making	Psychological distress (GHQ-12)	Work factors associated with distress (canonical correlations= $0.53$ and $0.41$ , $p<0.001$ )
Petterson <i>et al</i> , 1995 <sup>26</sup>	Sweden	Cross sectional	2568 nurses	76%	Job influence	Emotional exhaustion (MBI)	Job influence negatively associated with emotional exhaustion ( $p<0.001$ )
Pisarski <i>et al</i> , 1998 <sup>27</sup>	Australia	Cross sectional	172 nurses, aged 21–40 years	Not reported	Social support	Psychological distress (GHQ-12)	Co-worker social support directly associated with distress and mediates association with supervisor social support (path coefficients $<0.001$ )
Revicki and May, 1989 <sup>28</sup>	USA	Cross sectional	232 nurses	77%	Organisational climate, supervisor behaviour, role ambiguity, social support	Depression (Rand Corporation)	The association of organisational climate and role ambiguity with depression is mediated by stress

key work factors associated with psychological ill health were: work overload and pressure<sup>31 34 36 39–40 41 47 48</sup>; conflicting demands<sup>47</sup>; lack of control over work and lack of participation in decision making<sup>34 36 37 39 40 46–48</sup>; poor social support at work<sup>31 33 35 38 39 41 47 48</sup>; unclear management and work role<sup>29 30 41 34 38</sup>; interpersonal conflict<sup>42 46</sup>; and conflict between work and family demands.<sup>46</sup> Long hours were found to be associated with depression in women, but not in men.<sup>44</sup>

Sickness absence was negatively associated with high job demand,<sup>45</sup> and positively associated with monotonous work, not learning new skills and low control over work,<sup>36 37 45</sup> and non-participation at work.<sup>43</sup>

### Evaluated interventions

Six intervention studies met our methodological criteria (table 4). Three were randomised controlled trials,<sup>49 50 52</sup> three were conducted in the USA,<sup>50 51 54</sup> one in the UK,<sup>53</sup> and two in Scandinavia.<sup>49 52</sup> Three were of health care workers.<sup>50 52 54</sup> Five were training programmes offered as part of the working day and one was an organisational intervention.<sup>53</sup>

Skills to mobilise support at work and to participate in problem solving and decision making were taught to care staff of people with mental ill health or mental disability in a randomised controlled trial.<sup>50</sup> Groups of 20 had six sessions of 4–5 hours training over two months, and were trained to train

those in their workplace. Compared to those in the control group, the intervention group reported more supportive feedback, more ability to cope, and better work team functioning and climate. Among those most at risk of leaving, those undergoing the training reported reduced depression. The second randomised controlled trial compared receiving support, advice, and feedback from a psychologist with having the passive presence of the same psychologist at staff meetings in a geriatric hospital facing organisational change.<sup>52</sup> Staff were taught skills of stress management, and how to participate in, and control, their work. The intervention was an hour a fortnight during the 10 weeks before, and the 10 weeks after, the organisational change. There was a significant difference between groups, with a decrease of stress hormone levels in the intervention group.

Staff of a psychiatric hospital were taught verbal and non-verbal communication and empathy skills.<sup>54</sup> Groups of 6–8 had eight hour weekly sessions for four weeks involving information, videos, modelling, and role playing. Compared to a matched control group, the intervention group showed reduced staff resignations and sick leave, although no statistical tests are reported.

Among physically inactive employees of an insurance company, a randomised controlled trial found stress management training and aerobic exercise interventions had mixed

**Table 3** Summary of observational studies of associations between work factors and ill health: non-health care workers

Study	Country	Design	Participants	Response rate	Work factors	Outcomes	Results
Bacharach <i>et al</i> , 1991 <sup>29</sup>	USA	Cross sectional	430 public sector engineers	79%	Role conflict, time pressure	Emotional exhaustion (MBI)	High role conflict (B=0.24) associated with emotional exhaustion
Carayon <i>et al</i> , 1995 <sup>30</sup>	USA	Prospective	148 public sector office workers	71%	Job demands, content and control, social support, task clarity and job future ambiguity	Worker strain, including anxiety and depression (McNair)	Predictors of worker strain at one and two years were task clarity and job future ambiguity
Driscoll <i>et al</i> , 1995 <sup>31</sup>	USA	Cross sectional	4900 public sector workers	70%	Job demands, control and social support	Anxiety and depression (NIOSH Generic Job Stress Questionnaire)	High demand and low support associated with anxiety (ORs 1.46 and 2.01) and depression (ORs 2.02 and 1.69)
Ferrie <i>et al</i> , 1998 <sup>32</sup>	UK	Prospective	10308 public sector workers	80%	Job insecurity	Psychological distress (GHQ-30)	Non-significant association
Frese, 1999 <sup>33</sup>	Germany	Longitudinal	90 male blue collar workers	35–66%	Work intensity, uncertainty, organisational problems, environmental problems, social pressure, social support	Anxiety, depression	Social pressure and support associated with anxiety/depression (r=0.21/0.20 and -0.21/-0.27)
Frone <i>et al</i> , 1995 <sup>34</sup>	USA	Longitudinal	795 employed adults	67%	Work pressure, lack of autonomy, role ambiguity	Depression (CES-D)	Work pressure, lack of autonomy, role ambiguity all associated with depression (Bs=0.10, p<0.01; 0.19, p<0.001; 0.18, p<0.001, respectively)
Fusilier <i>et al</i> , 1987 <sup>35</sup>	USA	Cross sectional	312 police officers and fire fighters	65%	Role conflict and ambiguity, social support	Depression (Caplan)	Low social support associated with depression (B=-0.24, p<0.01)
Karasek, 1979: Study 1 <sup>36</sup>	Sweden	Longitudinal	1896 working males	92% and 85%	Decision latitude and job demands	Depression (amended from American Health Survey), absenteeism	Decision latitude negatively associated with depression and absenteeism (OR=-1.29, p<0.05 and -1.44, p<0.01). Job demands associated with depression (OR=1.45, p<0.001)
Study 2	USA	Cross sectional	911 working males	76%	As above	As above	Decision latitude negatively associated with depression and absenteeism (OR=-1.41, p<0.01 and -2.04, p<0.001); job demands associated with depression (OR=1.20, p<0.05)
Karasek, 1990 <sup>37</sup>	Sweden	Cross sectional	8504 white collar workers	87%	Changes in control over work	Depression and absenteeism	Decreased control associated with depression (p<0.01) and with absenteeism in men (p<0.01) but not women
LaRocco <i>et al</i> , 1980 <sup>38</sup>	USA	Cross sectional	636 male workers	Not reported	Supervisor support, participation, future ambiguity, under-utilisation, workload, role conflict	Anxiety and depression (Cobb and Kasl)	Supervisor support buffers the adverse effect of low participation on depression (p<0.1, significant) and of future ambiguity on anxiety (p<0.01)
Niedhammer <i>et al</i> , 1998 <sup>39</sup>	France	Prospective	11552	92%	Psychological demands, decision latitude and social support	Depression (CES-D)	High psychological demand, low decision latitude and social support associated with subsequent depression. For men, OR of 1.8, 1.4 and 1.6 respectively and for women, OR of 1.4, 1.4 and 1.3 respectively.
Payne and Fletcher, 1983 <sup>40</sup>	UK	Cross sectional	148 teachers	74%	Workload demands, discretion	Anxiety and depression (CCEI)	Association with workload demands (betas=0.117 for anxiety and 0.176 for depression) and negative association with discretion (betas=-0.222 for anxiety and -0.121 for depression)
Reifman <i>et al</i> , 1991 <sup>41</sup>	USA	Cross sectional and longitudinal	200 married, professional women	>90%	Social support at work, control over work, role ambiguity, workload	Depression (SCL-90)	Cross sectionally, association with social support at work (r=0.37), role ambiguity (r=0.35) and workload (r=0.29). No associations one year later
Romanov <i>et al</i> , 1996 <sup>42</sup>	Finland	Prospective	15530 employees	Not reported	Conflict at work	Psychiatric morbidity (hospital discharge registry)	Positive association (RR 2.18, CI <sub>95</sub> 1.34, 3.54)
Rubenowitz <i>et al</i> , 1983 <sup>43</sup>	Sweden	Cross sectional	25 departments of 5 companies. Numbers not reported	85–90%	Perceived participation (individual, group, representative)	Absenteeism	Negative association for individual participation (r=-0.53)
Shields, 1999 <sup>44</sup>	Canada	Prospective	3830 working population	80%	Long working hours	Depression (Composite International Diagnostic Interview)	>35 hours per week associated with depression in women (OR=2.2) but not men
Smulders and Nijuis, 1999 <sup>45</sup>	The Netherlands	Cross sectional and prospective	1755 male public sector workers	70%	Job control and job demands	Absence rate and absence frequency	Cross sectionally, job control associated with low absence frequency (beta=0.10, p<0.01) and job demand associated with low absence rate (beta=-0.08, p<0.05)
Sparks and Cooper, 1999 <sup>46</sup>	UK	Cross sectional	7099 from 13 occupations	Not reported	Work control, career achievement, organisational climate, job factors, home/work interface, work relationships	Mental health (OSI)	All associated (r=0.22 to -0.28, p<0.001)
Stansfeld <i>et al</i> , 1995 <sup>47</sup>	UK	Cross sectional	10314 public sector employees	73%	Job variety and skill use, control, social support, work pace, conflicting demands	Psychological distress (GHQ-30)	All significantly associated (intertile trend p values < 0.001)
Stansfeld <i>et al</i> , 1998 <sup>48</sup>	UK	Prospective	7372 public sector workers	72%	Job demands, decision latitude, social support and effort-reward imbalance	Psychological functioning (SF-36)	Low support and effort-reward imbalance associated with poor psychological functioning (OR=1.2 for men and 1.4 for women; 1.8 for men and 2.3 for women respectively). In men, low decision latitude (OR=1.2) and in women, high job demand (OR=2.0) were associated with poor psychological functioning

effects.<sup>49</sup> After three sessions a week for 10 weeks, stress management training resulted in improved perceived coping ability but no change in physical or psychological health. Aerobic exercise resulted in improved feelings of wellbeing and decreased complaints of muscle pain.

Employees of a fire department underwent one of seven training programmes emphasising one or more aspect of stress management: physiological processes, coping with people, or interpersonal awareness processes.<sup>51</sup> Weekly sessions for 8–10 people were run over 42 weeks. There was no control group. Compared to baseline, there were reductions in depression, anxiety, psychological strain, and emotional exhaustion immediately after the programme. There was a further reduction in psychological strain and emotional exhaustion at 9–16 months follow up.

A structural intervention for local authority staff on long term sickness absence was effective in reducing sickness absence. Referral to occupational health services was triggered after two or three months absence, rather than at six months which was the practice before the intervention. The average duration of sickness absence reduced from 40 to 25 weeks before resumption of work and from 72 to 53 weeks for those staff who left employment for medical reasons. The authors describe large financial savings but no statistical tests are reported.<sup>53</sup>

## DISCUSSION

This systematic review of a large number of studies covers a wide range of employment sectors in the developed world and summarises those studies that use rigorous methods. The studies show that, while levels of psychological ill health are higher in health care than in non-health care workers,<sup>2</sup> the associations between work factors and psychological ill health are similar. They are also similar across continents. This suggests that a generic approach to reducing work related psychological ill health may be appropriate.

The most common work factors associated with psychological ill health were work demand (long hours, workload, and pressure), lack of control over work, and poor support from

## Main messages

- Key work factors associated with psychological ill health and sickness absence in staff are long hours worked, work overload and pressure, and the effects of these on personal lives; lack of control over work; lack of participation in decision making; poor social support; and unclear management and work role.
- There is some evidence that sickness absence is associated with poor management style.
- Successful interventions that improve psychological health and levels of sickness absence use training and organisational approaches to increase participation in decision making and problem solving, increase support and feedback, and improve communication.

managers. These were also associated with sickness absence. The findings of this review, summarised in tables 1–4, are consistent with the demand-control model of job strain.<sup>36</sup> Interventions aimed at changing these workplace factors reduced psychological ill health.

This review highlights limitations in the research identified. The studies that have been carried out are limited in the questions addressed and in the study designs used. Since most studies are cross sectional, causal relations cannot be shown. It may be that the associations found reflect a tendency for more vulnerable people to choose work in caring roles or other types of job which are well represented in published research studies. The question of what aspects of work lead to ill health and sickness absence can only be addressed by longitudinal studies that are able to investigate the causal relations between work factors and health outcomes and by randomised controlled trials of interventions. A longitudinal study that directly addressed the nature of the relation found a causal relation between psychological stress and psychosomatic complaints.<sup>55</sup>

There are several practical implications suggested by the studies of association in this review, for both employment

**Table 4** Summary of studies of interventions

Study	Participants	Design	Response rate	Intervention	Outcomes	Results
Gronningsaeter <i>et al</i> , 1992 <sup>49</sup>	76 physically inactive Norwegian insurance workers	Stratified RCT	72%	6 sessions aerobic exercise per week for 10 weeks or 3 sessions stress management training per week for 10 weeks	Anxiety (STAI) and health complaints	No association of either intervention with anxiety. Aerobic exercise associated with reduced health complaints (F=3.4, p=0.07 compared to controls, and F=4.8, p<0.05 compared to stress management intervention)
Heaney <i>et al</i> , 1995 <sup>50</sup>	1375 US residential care workers	Cluster RCT	62%	6 × 4 hour sessions over 9 weeks to teach skills to enhance social support and problem solving	Depression (SCL-90R)	For those most at risk of leaving their jobs, R <sup>2</sup> =0.41, p<0.01
Kagan <i>et al</i> , 1995 <sup>51</sup>	373 US fire department workers	Randomised, uncontrolled	Not reported	42 weeks of 7 psycho-educational programmes, 6 weeks each	Anxiety, depression, psychological strain, emotional burnout	Compared to baseline, F=52.3, 42.2, 29.1, 10.6 respectively; p<0.001 for all. At 9–16 month follow up, F=4.8 (p<0.05), 8.7 (p<0.01), 21.4 (p<0.001), 45.2 (p<0.001) respectively
Lokk and Arnetz, 1997 <sup>52</sup>	26 Swedish hospital ward workers	RCT	93%	20 weekly 1 hour stress management sessions	Stress hormone (prolactin) level	Change scores: Intervention group -0.58 Control group +1.85 F=7.3, p<0.01
Malcolm <i>et al</i> , 1993 <sup>53</sup>	604 UK long term sick local government workers	Observational	100%	Early referral to Occupational Health	Duration of sickness absence (weeks)	25 weeks in intervention period compared to 40 in control period
Smoot and Gonzales, 1995 <sup>54</sup>	65 US hospital workers	Matched controlled	90%	4 weekly 8 hour sessions of communication training	Sick leave (hours) in 6 months after compared to 6 months before	% change: -28.2 in experimental group, -6.4 in control group

### Policy implications

- Many of the work related variables associated with high levels of psychological ill health are potentially amenable to change.
- More evaluations of interventions are required, based on randomised or longitudinal research designs.
- Interventions for which evidence of effectiveness exists should be piloted and evaluated across different work settings.

practices and management style. Intervention studies, however, have focused mainly on staff training. There is a need for future studies to evaluate interventions based on employment practices and management style. This would represent primary prevention, reducing sources of psychological ill health, rather than secondary prevention, training individuals who are already experiencing work related stress, to be more robust in the face of such pressures. Only one of the intervention studies included an economic evaluation: such evaluations are important in facilitating employers to make decisions about whether or not to implement interventions.

Future research should adhere to minimum scientific standards absent in many of the studies reviewed, such as adequate design, sufficiently large samples, and valid outcome measures. Lessons that are learnt from rigorously evaluated interventions can then be applied more generally.

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### Authors' affiliations

**S Michie**, Reader in Clinical Health Psychology, Centre for Outcomes Research and Effectiveness, Department of Psychology, University College London, Gower Street, London WC1E 6BT, UK  
**S Williams**, Consultant in Occupational Medicine, Royal Free Hampstead NHS Trust, London NW3 2QG, UK

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### Air pollution study confirms concerns over childhood rickets

A study in India has shown that young children living in areas of high air pollution are in danger of developing rickets.

Two groups of age matched infants and toddlers were compared for serum vitamin D metabolites, calcium, alkaline phosphatase (AP), and parathormone (PTH) concentrations. One group lived in a central location in Delhi and the other on the outskirts of the city, where air pollution is much lower.

Children from the city centre had significantly lower mean serum total 25-hydroxyvitamin D (25(OH)D)—an indicator of vitamin D status—than children from the outskirts (12.4 ng/ml v 27.1 ng/ml). Their mean serum AP and PTH concentrations were significantly higher, and the inverse relations between 25(OH)D and AP, PTH were also significant. Three children had serum total 25(OH)D low enough to indicate rickets, and nine more below adequate amounts. All children from the outskirts had adequate 25(OH)D. Mean haze score was significantly less at the city centre (2.1 against 2.7).

Each group included 34 children aged 9–24 months with similar home conditions, diet, family income, and time spent outside. Blood was taken from 26 children from the city centre and 31 from the outskirts. Haze scores measured at ground level three times daily (0900, 1200, 1600) during February 2000 were taken as a marker for UVB radiation.

Concerns are growing that increasing air pollution from industry and motor vehicles blocks out UVB radiation and children's ability to make vitamin D naturally, leading to rickets.

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